May 1990

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Just for your Tandy Color Computer 1, 2 and 3

The RAINBOW

THE COLOR COMPUTER MONTHLY MAGAZINE

In Print

Booklets
OS-9 Labels
CoCo Typer

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SUNDOG SYSTEMS

Sinistaar

Sundog Systems proudly presents the first 512K arcade game available for your CoCo III! If you don't have 512K, you will want to get it just for this game! The evil Sinistaars have invaded the galaxy and it falls to you to destroy them. These fiends will attempt to hold you with a constant barrage of drone ships while they muster their strength, and eventually find and obliterate you. Your mission is to mine the myriad asteroids in search of the precious ore which can be refined into sinibombs, your only weapon against the Sinistaars. Many surprises await as you advance through the increasingly difficult stages. Experience the fast-paced action of 512K packed with spectacular graphics, sound effects, and voices! Dozens of stages will keep you coming back for more. Req. 512K CoCo III and disk drive.

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Something is killing off the members of the legendary order of Kyum-Gai. In desperation, its leaders have called upon the powers of the life stone to resurrect you, their greatest hero: the NINJA GAI-DAN. Now, you must find and destroy the evil forces behind this dark plot. Use a multitude of martial arts moves to defeat your enemies, obtain treasure and weapons, and evade obstacles. *Kyum-Gai: to be Ninja* uses the most detailed 320x200 resolution, 16 color graphics, the highest quality digital sound effects, and spectacular animation to bring you the greatest martial arts game your CoCo III has ever seen. Created by the author of *Warrior King*, this incredible arcade game is a definite must for your CoCo III software collection. Join the ranks of the Kyum-Gai and find out what it means to be Ninja! Req. 128K CoCo III, disk drive, and joystick (2-button joystick supported).

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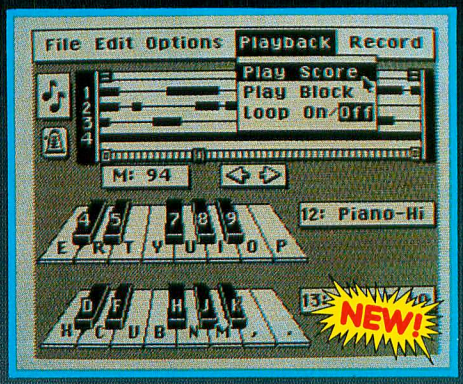
SoundTrax



SoundTrax is an unprecedented sound sequencing system for the CoCo III. It requires *no* extra hardware (i.e. midi keyboards, cables, etc.). All of it is contained in your CoCo. This amazing program will read in a digitized sound and play back all of the notes in the octave in which it was recorded. And it's POLYPHONIC! You can sequence up to four voices at one time, and not only the same sound! With as many voices as can be held in your memory, depending on the song, you can create a score of up to THREE DAYS in length using drums, horns, strings, even your own voice! And you can play them all together! Using the built-in windowing point-and-click editor, you can cut, paste, even synchronize the score to just the way you like it. Use the pre-sampled sounds from the disk included, or make your own by importing them from some of the more popular digitizers available. Also, CALL for the availability of extra sound sample disks! Get it today; you won't believe your ears! Req. 128K CoCo III, mouse/joystick, and disk drive.

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Years after the mysterious hero called the Paladin disappeared, loathsome creatures, spawned from the bowels of the planet, have overrun the land of Tarinth and captured the king. The situation is grave, for without the king's influence, the three nations will not unite against the growing evil. Only one pure of heart can master the five magics and thereby fulfill the Paladin's legacy and save the realm. Adventure into this vast land of fantasy, interract with its inhabitants, explore the ruinous mines, and do battle with supernatural forces. Experience the magic of the quest in this fast-paced role-playing adventure, all in the familiar quick scrolling, bird's eye play format. You will love the feeling of playing an action game with great graphics, animation, and sound effects, but all the while solving one of the most involved adventures yet. Tarinth awaits its savior! Available for all CoCo models! Req. 64K CoCo and disk drive.

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Exits: W U
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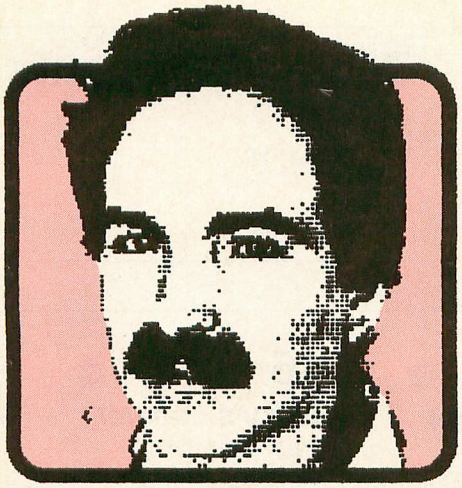
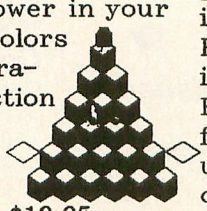


Pyramix

This is a fascinating CoCo 3 game of skill and coordination. Pyramix is 100% machine language written exclusively to take advantage of all the power in your 128K CoCo 3. The Colors are brilliant, the graphics sharp, the action fast. Written by Jordon Tsvetkoff and a product of ColorVenture. **Disk: $19.95**

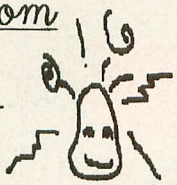


The Freedom Series

Vocal Freedom

Vocal Freedom turns your computer into a digital voice recorder. The optional Hacker's Pac lets you incorporate voices or sounds that you record into your own BASIC or ML programs. This is not a synthesizer. Sounds are digitized directly into computer memory so that voices or sound effects sound very natural. One "off-the-shelf" application for Vocal Freedom is an automatic message minder. Record a message for your family into memory. Set Vocal Freedom on automatic. When Vocal Freedom "hears" any noise in the room, it plays the prerecorded message directly from its Random Access Memory with amazing fidelity! You may also SAVE or LOAD sounds to and from DISK. VF also tests memory to take advantage of from 64K up to a full 512K. Requires low cost amplifier (RS cat. #277-1008) and any microphone. Will run on a CoCo 1, 2, or 3. Vocal Freedom **Disk: $34.95.** Optional Hacker's Pac **Disk: $19.95. Disk for both: $49.95**

Mental Freedom



Would your friends be impressed if your computer could read their minds? Mental Freedom uses the techniques of Biofeedback to control video game action on the screen. Telekinesis? You control the action with your thoughts and emotions. Your goal is to materialize and levitate objects with the power of your mind while avoiding the insidious cobra. Mental Freedom teaches peace of mind in the face of adversity. Mental Freedom even talks in a perfectly natural voice without using a speech synthesizer! Requires Radio Shack's low cost Biofeedback monitor, Cat. #63-675. Will run on a CoCo 2 or 3 but not CoCo 1. **Disk: $24.95**

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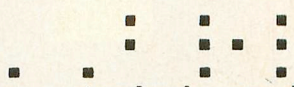
COCO Braille



Produce standard grade 2 Braille on a Brother daisy wheel printer. Easy to use for sighted or blind user. No knowledge of Braille is necessary. Call for free sample. Will run on CoCo 1, 2, or 3. **Disk: $69.95**

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RAINBOW

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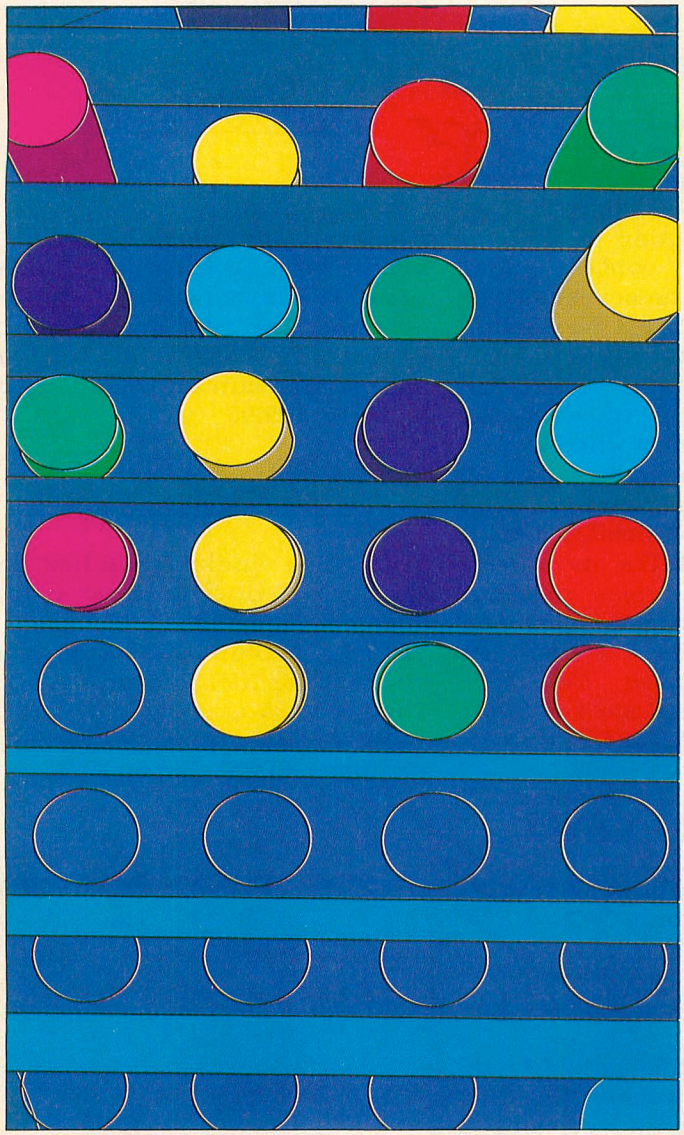

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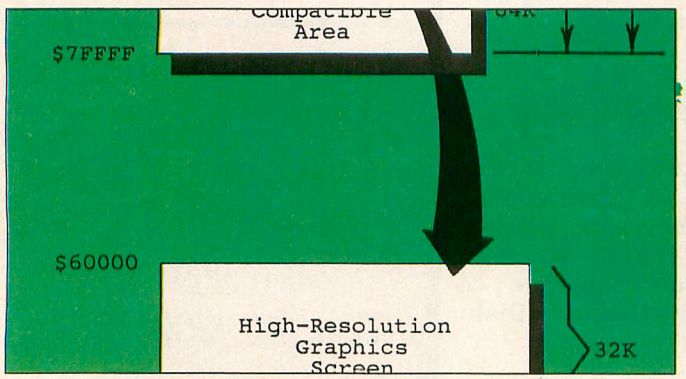

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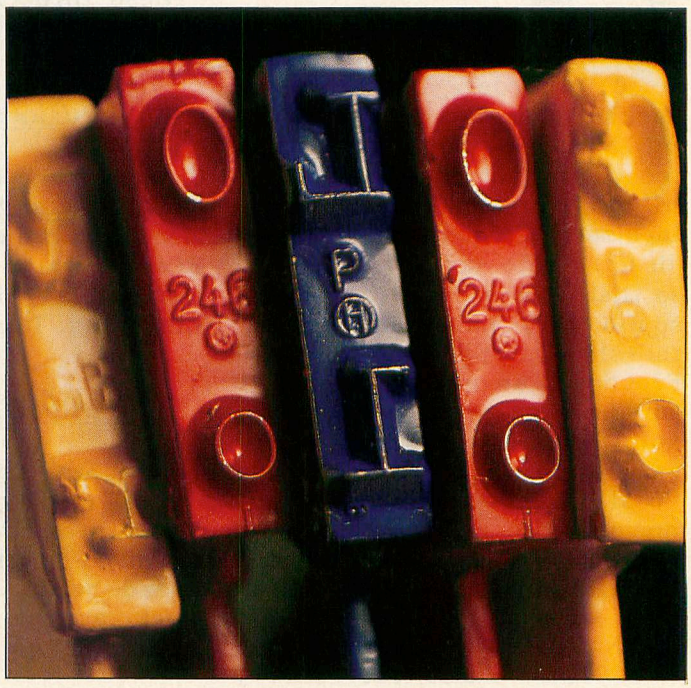

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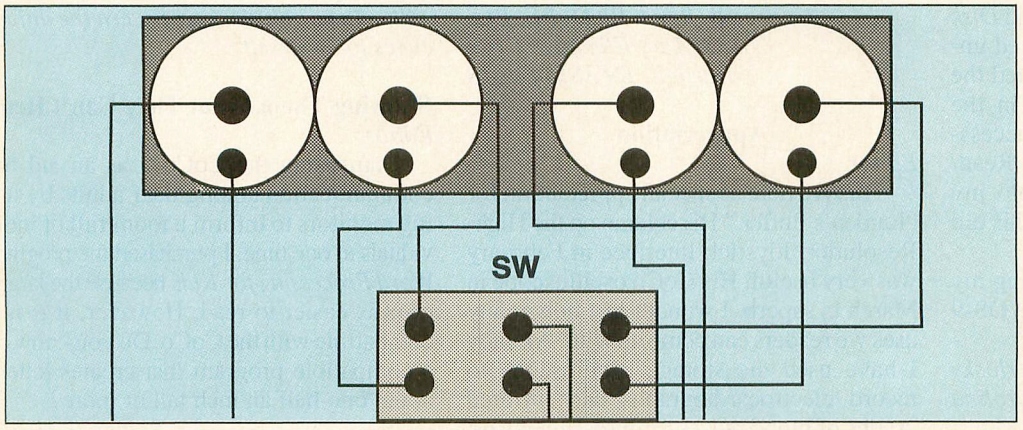

The cassette tape/disk symbols beside features and columns indicate the program listings with those articles are on this month's RAINBOW ON TAPE and RAINBOW ON DISK. Those with only the disk symbol are not available on RAINBOW ON TAPE.

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Cover illustration by Heidi Nelson

Letters to the RAINBOW

Editor:

I am having problems using an FD-502 dual disk drive with OS-9 Level II.

I purchased these drives to have my system on Drive 0, BASIC09 on Drive 2, and drives 1 and 3 left for programs and files. I am not able to accomplish this with Tandy's software.

Page 7-4 of "Getting Started With OS-9, Customizing Your System," lists Device D3_40D while my OS-9 Level II Boot/Config/BASIC09 directory lists no such module.

To install this module and device descriptor I purchased *OS-9 Utilities* and *Disk Fix* from Computerware. This proved unsuccessful, however. I also completed the quick fixes by Marty Goodman, in the October 1988 issue (pages 58-62), successfully on my FD-502 that has four Read/Write heads and plugs directly into my 512K CoCo 3 port. Unfortunately this did not solve my problem.

I am almost to the point of selling my computer, software and kissing both OS-9 and Tandy goodbye. Can you help?

John T. Gerlosky
Fayetteville, North Carolina

Double-sided drives are handled quite differently under OS-9 than they often are under Disk BASIC. The stock drive descriptors of OS-9 consider both sides to be one drive. Therefore, you shouldn't try to do the 0, 2 — 1, 3 split for two double-sided drives. Just use the `d0_40d.dd`, `d1_40d.dd` *and* `ddd0_40d.dd` *descriptors to set your system up for two double-sided drives.*

Trying My Hand at C

Editor:

I am an old FORTRAN programmer trying his hand at C on a 512K CoCo 3 with 20-Meg hard drive. I'm looking for additional aids to speed up my programming efforts. In the November 1988 issue of THE RAINBOW, the "KISSable OS-9" column reviewed *CCENV*, the OS-9 Compiler/Assembler Environment produced by Chris Fox. The last FoxWare ad for *CCENV* appeared in your October 1988 issue. About a year ago I wrote to FoxWare but received no reply. Is *CCENV* available from any other source?

Also I am looking for a source of additional C standard libraries such as the *Math Library*. I am interested in any libraries, tools, utilities, debuggers, etc., for the C language. I purchased several textbooks that talk about these programming aids but give no details.

While the manual for the Microware C compiler seems to lead one to believe a CoCo 3 version is forthcoming, such has not materialized. Are there any C compilers out there that take advantage of the full capabilities of the 512K CoCo 3? It seems to me there should be a good market for a 512K CoCo 3 C compiler based on the proposed ANSI C. Such an implementation should include bit-field operations.

George B. Reed, Ph.D, PE, PLS
6133 Mary Elizabeth Cove
Bartlett, TN 38134-3618

Appreciation

Editor:

This is a note of special appreciation for "Barden's Buffer." His column on the High-Resolution Joystick Interface in February was very useful. His CoCo oscilloscope in March is superb. I wonder just how many uses we readers can come up with. Already I have used the storage oscilloscope to record electrocardiographs and infrared graphs of blood pulses through finger tips.

I also want to compliment you for the continued great articles and answers from Marty Goodman over the years.

R.R. Simpson
Manhattan Beach, California

How Can I Draw the Line?

Editor:

I own a Color Computer 3, a DMP-132 printer and a *Scripsit* word processor and have been unable to get help from the store in this area. The problem is that I cannot underline or draw a straight line in my text with the given Hex code. Can someone please help me?

Mrs. W. Harrington
Route 1, Box 301
Calvert City, KY 42029

Treading On Unknown Ground

Editor:

I need help with my latest purchase, *EDTASM 3*. I tried to enter the code from William P. Nee's articles on machine language, intended for the *EDTASM+* cartridge. It appears the commands are not compatible and the manual assumes prior knowledge of machine language. Can anyone recommend a book that lists the *EDTASM 3* commands and their differences from those of other assemblers?

Perry Friesen
Box 4407
Three Hill, Alberta T0M 2A0
Canada

We are not aware of any book comparing EDTASM 3 *commands with other assemblers. But you might bone up on assembly by purchasing the assembly language books offered by Tepco and William Barden. This will help as you work to discern the differences for yourself.*

Showing Them What They Can't Hear

Editor:

I am using the CoCo 3 as an aid for communication among deaf adults by using monitors to inform a room full of individuals at one time. I purchased the program *Word Processing for Kids* because the larger print is easier to read. However, it is not compatible with the CoCo. Do you know of a compatible program that creates letters about one-half an inch tall or more?

Sidney B. Howie
R.D. 10 Lake Louise Dr.
Carmel, NY 10512

A Close Look at Listings

Editor:

I don't have the eyes of a young man, and, although I'm only 50 years old, my eyes aren't what they used to be. I've discovered something that may help other readers who, like myself, enjoy typing in the listings from your magazine.

Recently on a shopping trip, my wife found an interesting item called a Magnifine Lamp. It is a lighted magnifying glass on adjustable arms and a weighted base. All I have to do is set it on my desk, place THE RAINBOW on a small easel, put the magnifying glass into place, turn on the light and type to my heart's content. With my Magnifine Lamp I get the large print listing and you get the compact space in your magazine. This is what I call the best of both worlds.

Ronald H. Roberts
Brandon, Wisconsin

Thanks for your support. We received another letter in which the author pointed

CIII Pages

by Walter Bayer

The *ultimate* **desktop publishing** program for the CoCo 3. Pull-down menus, icons & dialog boxes, drawing tools (create boxes, polygons, rays, circles, ellipses, brush shapes), cut, copy, stamp, paste, zoom, flip, enlarge/reduce, rotate, stretch, undo, import any ASCII text, 2/3 columns & page preview. Includes 14 fonts & 60 pieces of clip art. Req. CoCo 3, RGB/ Monochrome Monitor, Min 1 drive, Tandy Hi-Res Interface, Joystick/mouse & DMP 105/106/Epson/Gemini & Compatible Printer. Only **$49.95**. w / Hires Inteface Only **$59.95.**

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out a different solution. He said he is rarely interested in all the listings in a given issue, so he picks the ones he wants, takes the magazine to a copy shop and has those listings enlarged.

Put on Your Sunglasses

Editor:

With reference to the letter in February from Billy Pogue concerning old eyes and program listings, it's easy to find out for yourself how small type looks against a colored background. Just put on a pair of sunglasses and try to tell the difference between a period and a comma, or a semicolon and a colon. I can cope with the small print, and I can cope with the dark background, but both together is a bit rough.

Lee Anderson
New Glasgow, Nova Scotia
Canada

We have received similar complaints and are working on a solution to the background problem.

Response to Herbert Enzman

Editor:

I am writing this in response to a letter by Herbert Enzman in the July 1989 issue. The letter concerned confusion about ordering a part through Radio Shack's National Parts division.

I am a Radio Shack manager and could not believe the parts he wanted were not available, so I decided to call National Parts myself. As Mr. Enzman said, the repesentative said the company does not have the parts. Then I called the Computer Service Center for help in cross-referencing the numbers. I gave him the information that I read from Mr. Enzman's letter: Cat. No. 26-3029 MX-6429 and MX-6201. After a while he found that the number for the MX-6429 was 26-3129 and the Catolog Number MX-6021 was 26-3026.

I called National Parts again, with the correct numbers. They are available and in stock. The total cost for both is $21.85. I hope this helps Mr. Enzman and anyone else experiencing this problem.

Russell McCombs
Pittsburgh

Addition to "Mandelbrot Bug"

Editor:

I am very impressed with "The Mandelbrot Bug" in the January 1990 issue of THE RAINBOW (Page 77) by Jeremy and Marty Spiller.

It works perfectly in every way except one. I discovered this when, after many hours of work, I used a disk with insufficient granules on it and lost everything.

This small addition to Line 1275 keeps this from happening:

```
1275 IF FREE (0) <16 THEN PRINT
"NOT ENOUGH SPACE - CHANGE DISKS
": PRINT" (PRESS ANY KEY TO CONT
INUE)": EXEC44539:GOTO1275
```

Sheridan Wilson
Jamaica, New York

THE RAINBOW welcomes letters to the editor. Mail should be addressed to: Letters to Rainbow, The Falsoft Building, P.O. Box 385, Prospect, KY 40059. Letters should include the writer's full name and address. Letters may be edited for purposes of clarity or to conserve space.

Letters to the editor may also be sent to us through our Delphi CoCo SIG. From the CoCo SIG> prompt, type RAI to take you into the Rainbow Magazine Services area of the SIG. At the RAINBOW> prompt, type LET to reach the LETTERS> prompt and then select Letters for Publication. Be sure to include your complete name and address.

The Rainbow Introductory Guide to

Statistics

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...Just think of any word processing feature, chances are Word Power has it...packs a lot of features...excellent word processor..." **Word Proc. Comparison**-April 1989 Rainbow; Pg 26.

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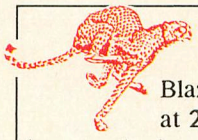

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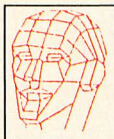

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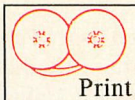

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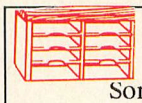

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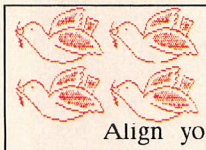
Sort lists in a flash!



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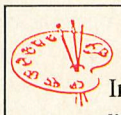

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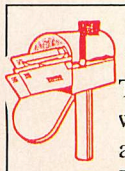

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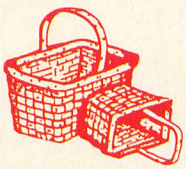

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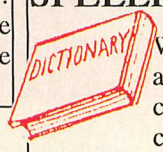

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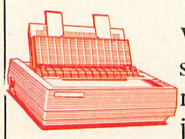
Word Power 3.3 include a **80,000** word spelling checker which finds and corrects mistakes in your text.



PRINTING

Works with **all** printers that work with the CoCo. Allows options such as baud rates, spacing, page/print pause, partial print, page numbering/ placement, linefeeds, multi-line headers/footers, right justification and number of copies. The values of these options can be changed in the text by embedding Printer Option Codes. The **WHAT YOU SEE IS WHAT YOU GET** feature allows you to preview the text on the screen as it will appear on the printer. You can view margins, page breaks, justification and more.

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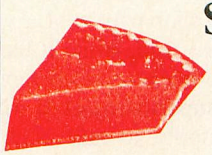
This checker will proofread your text for punctuation errors such as capitalization, double-words, a/an usage, spaces and more. Its the perfect addition to any word-proccessor.



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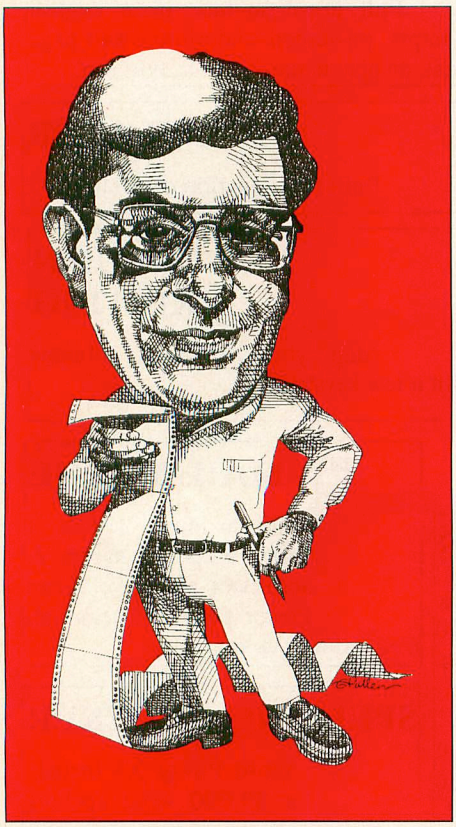

May is a magic month here in Kentucky, because it is the month during which the Derby is run. In this part of the world the Kentucky Derby is a major harbinger of spring and means that at long last winter has ended.

Spring is a time of renewed hope and aspirations, a time of rebirth. Even the earliest peoples celebrated spring as a time of life and living that carries us into two major celebrations of our Judeo-Christian heritage, Passover and Easter, which occur in early spring.

Concerning computers, spring is also a celebration of creativity. Since we at THE RAINBOW are into publishing, writing and art, we fit right in with all the creative activities.

I suppose that is why our editors seem to choose this time of year to focus on graphics. The Chinese teach us that a picture is worth a thousand words — the pictures you can create on your Color Computer certainly are. This is one of the reasons THE RAINBOW has always been so fascinated with pictures and why we run our CoCo Gallery section to showcase what you, our readers, have created.

And what a far way we have come! Consider the multiple options available to anyone in the area of graphics today. In the early days with my first Color Computer, I considered it pretty neat to draw block graphics on the screen in color. Today's applications, which allow editing of bit images, are truly something.

And you need not be an artist, either (which I certainly am not). The huge variety of art libraries available means almost anyone can use artwork to enhance whatever it is he may be doing without knowing how to draw a thing. This is truly marvelous for those of us to whom stick men are a great personal artistic endeavor.

What it all means, though, is that we have brought the world of publishing to every Lions Club and bowling league, every computer user's group newsletter and neighborhood newspaper.

Jim Burmeister and I grew up in Glendale, one of St. Louis's suburbs, and used to publish a neighborhood newspaper. I had a little printing press that used rubber type that you slid, letter by letter, into metal slots. The type had to be put in backward so the letters would come out correctly when the ink transferred to paper.

This "newspaper" came out weekly but was, by virtue of its very intensive hand work, only about 10 or so lines long. We labored long and hard over the newspaper and produced it for about six months.

I still recall the day when the company that sold this little printing press came out with a way to glue rubber cutouts onto the little slots and sent me a mailer selling this process. For about $5 and with much pride, we were able to add graphics to our newspaper.

Just before sitting down to write this monthly note to you all, I fantasized about getting inside a time machine and taking my computer and printer back to those days when I was a boy. Since the most difficult job we had was actually setting the type, we would have eliminated that chore almost completely and ended up with plenty of time to cover the waterfront. In short, our whole enterprise would have changed from a mechanical job to a creative one.

Graphics, type, printers and all the other aspects of these activities would have made *The Brownell News* much more fun to do and more interesting to read. This is why, I suppose, I am so interested in computers more than anything else. They allow us to be creative without allowing the process of that creativity to get in the way.

* * * * *

I want to call your attention to one of our newest advertisers — PCM.

Sometimes we get so caught up in what we are doing that we don't see everything clearly. This is a case in point.

About two years after we began publishing THE RAINBOW, we launched PCM, which now covers all the Tandy MS-DOS and portable computers. Shoot, I thought almost everyone knew about it. After all, *I* knew it.

Over the past several months, we have received many letters from RAINBOW subscribers indicating they have added an MS-DOS computer to their setup. Some have asked for our recommendation concerning a magazine "like THE RAINBOW" for their new machines. Most have been surprised to learn we also publish PCM.

I believe (being prejudiced, of course) that we do as good a job with PCM as we do with THE RAINBOW. And, while it focuses on the Tandy line because we believe its line to be clearly superior, most of what is in PCM's pages apply to any computer running MS-DOS.

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—Lonnie Falk

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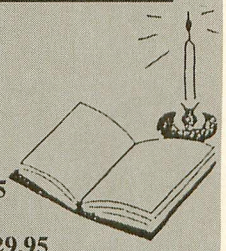

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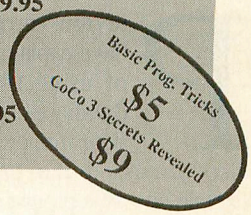

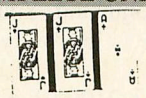

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Understanding the system and how to use it on a regular basis

Do-It-Yourself Database, Part IV

by Richard Perlman

Previous articles in this series have explained the why and how of using BASIC to construct a database to help you manage your money. These articles have also discussed the DATAB program. I'll explain how two programs, RETRV and DATAB, are chained together to form the complete system, as well as how to use this system on a regular basis.

Considering that the CoCo has only about 1/10 the memory and speed of an IBM PC-compatible computer, you will be amazed at what the system can do. Among its features is the ability to record bills, payments and money set aside to make the payments. You enter the activity as it occurs and can then go back to mark payments (checks) and deposits that have cleared your account, mark bills paid, and cross reference bills with the checks that paid them. All of this is done under menu control and with full screen displays that accept your information as fast as you can type it in.

I will show you how to produce a statement by running the Check and Deposit Report and how to produce an unpaid balance report by running the Check and Bill Report. You will see how you can use this system to manage your money whether you have a checking account or not. I will also explain how you can add reports of your own design; how to modify this database for other uses; how to work with a cassette instead of a disk; how to protect yourself against disk, human and other errors; and what to look for in off-the-shelf database packages that you might want to purchase in the future.

Richard Perlman spends his time at work helping others use their PCs. At home, he shares his CoCo 2 with his wife and two children. He may be contacted at 83-84 169 Street, Jamaica, NY 11431

Ins and Outs

The DATAB program is the front-end of the system. It is used to get information into the database and to correct information if it was entered incorrectly. Once you have good data, use an Output Writer to produce reports directly from the information stored in the database. Since DATAB has all of the coding needed to get information in and out of the database, I thought I could simply add a little more coding to DATAB. Unfortunately, there is not enough room in the 64K memory of the CoCo 1 and 2 to expand DATAB this way.

Memory

As DATAB grew I found my computer ran out of memory. This first happened after I added only a few lines of code. I got an error message but it didn't make much sense. When I removed the new lines of code, the program size shrunk and ran again. I wondered how large a program must become and how large was my program? The CoCo tells you with the MEM command. You can see how much memory is left by typing PRINT MEM.

DATAB grew to about 21000 bytes in length. Simple arithmetic shows that there should be 41K available in a 64K CoCo. But computers are not that simple. They all reserve a chunk of memory for the operating system and let you use only what is left. You only have about 22800 bytes in a 64K machine in which to run programs. I can't work with a program when a line or two of additional code exceeds available memory, so I created another program — an Output Writer named RETRV (short for retrieve). I'll present a listing for RETRV next month.

Using another program on the database is not a problem. Any number of programs can use our database as long as they follow the rules used when it was created. Just run DATAB to enter information and/or update the database, then run RETRV to output the information. After running RETRV you may want to make more changes, so run DATAB again, then RETRV, then DATAB, etc. Switching from program to program can become bothersome, however. I wanted this system to be easy to use, so I called CoCo to the rescue! Believe it or not, there is a feature

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in CoCo BASIC that allows you to use one program to run another one. Using one program to run another is called *chaining*.

Chaining

Chaining is accomplished by using the BASIC statement RUN *"new program name"*. When the computer comes to a RUN instruction in a program, it gets the new program from your disk and starts it running. No trace of the first program remains. This is called a *forward chain*. To get the first program back again, use a RUN *"old program name"* instruction in the new program where "*old program name*" is the name of the first program. This type of chain is called a *backward chain*. To use chaining in this system, I placed a RUN "RETRV" statement in DATAB and a RUN"DATAB" statement in RETRV. This backward and forward chain allows you to easily go back and forth between the two programs. For this reason, most of the RETRV menus have an option to let you chain to DATAB. Two is not a magic number; you can split a large program into any number of smaller ones. To see how chaining works, look at the example using small programs shown in Figure 1.

Any number of programs can use our database as long as they follow the rules used when it was created.

To run this test, do the following: Enter Program 1, type SAVE"PROGRAM1", type NEW, enter Program 2, type SAVE"PROGRAM2", type RUN"PROGRAM1". By inputting either 1 or 2 you cause either Program 1 or Program 2 to be loaded and run. Now you have an idea about how the system of chaining works.

Entering Data

To add checks, bills and deposits to the database, type RUN"DATAB". (The database must already have been created with the CREATE program published in the September 1989 issue.) The DATAB program menus are set up to let you continue to add a single type of record with a minimum of keystrokes. So gather a bunch of checks, deposits or bills and enter them one after the

Program 1

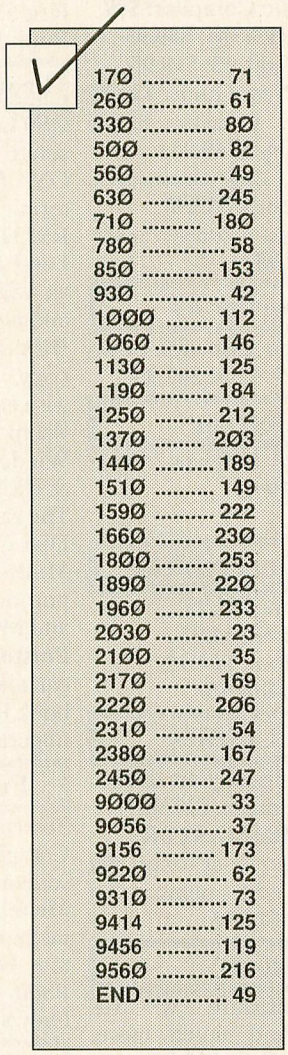
```
100 CLS:PRINT "PROGRAM 1"
110 PRINT "ENTER A NUMBER"
115 INPUT A
120 IF A = 1 GOTO 150
130 IF A = 2 GOTO 160
140 GOTO 100
150 PRINT "RUNNING 1 AGAIN"
155 RUN "PROGRAM1"
160 PRINT "RUNNING 2"
165 RUN "PROGRAM2"
```

Program 2

```
100 PRINT "2 IS RUNNING"
110 PRINT "ENTER A NUMBER"
115 INPUT A
120 IF A = 1 GOTO 150
130 IF A = 2 GOTO 160
140 GOTO 100
150 PRINT "RUNNING 1"
155 RUN "PROGRAM1"
160 PRINT "RUNNING 2 AGAIN"
165 RUN "PROGRAM2"
```

Figure 1: Example of Chaining

CoCo 3



```
17Ø ..... 71
26Ø ..... 61
33Ø ..... 8Ø
5ØØ ..... 82
56Ø ..... 49
63Ø ..... 245
71Ø ..... 18Ø
78Ø ..... 58
85Ø ..... 153
93Ø ..... 42
1ØØØ ..... 112
1Ø6Ø ..... 146
113Ø ..... 125
119Ø ..... 184
125Ø ..... 212
137Ø ..... 2Ø3
144Ø ..... 189
151Ø ..... 149
159Ø ..... 222
166Ø ..... 23Ø
18ØØ ..... 253
189Ø ..... 22Ø
196Ø ..... 233
2Ø3Ø ..... 23
21ØØ ..... 35
217Ø ..... 169
222Ø ..... 2Ø6
231Ø ..... 54
238Ø ..... 167
245Ø ..... 247
9ØØØ ..... 33
9Ø56 ..... 37
9156 ..... 173
922Ø ..... 62
931Ø ..... 73
9414 ..... 125
9456 ..... 119
956Ø ..... 216
END ..... 49
```

The Listing: DATAB

```
Ø ' COPYRIGHT 199Ø FALSOFT, INC
1ØØ FILES 3,1ØØØ
11Ø CLEAR 75Ø:DIM LI$(7):SS$=CHR
$(127):WF$="Ø"
12Ø PM$=" or type item number to
 change "
13Ø FOR I=1 TO 32:IF MID$(PM$,I,
1) <> " " THEN NEXT I ELSE MID$(
PM$,I,1)=CHR$(128):NEXT I
14Ø CLSØ:PRINT @Ø,"— MONEY MAN
AGER DATA BASE —a
15Ø LI$(1)="1= ADD INFORMATION
16Ø LI$(2)="2= CHANGE INFORMATIO
N
17Ø LI$(3)="3= DELETE INFORMATIO
N
18Ø LI$(4)="4= CHANGE WORKFILE D
RIVE
19Ø LI$(5)="5= RETRIEVE INFORMAT
ION
2ØØ LI$(6)="6= END SESSION
21Ø SL=128:NL=6:AD=Ø:GOSUB 9ØØØ
22Ø ON A GOTO 36Ø,18ØØ,13ØØ,27Ø,
35Ø,23Ø
23Ø PRINT @385,STRING$(3Ø,"*");
24Ø PRINT @417,"SESSION IS OVER
- BYE FOR NOW ";
25Ø PRINT @449,STRING$(3Ø,"*");
26Ø FOR I=1 TO 18ØØ:NEXT I:CLS:E
ND
27Ø CLSØ:PRINT "—— DRIVE SEL
ECTION ——d"
28Ø LI$(1)="1= PUT THE WORKFILE
ON DRIVE Ø
29Ø LI$(2)="2= PUT THE WORKFILE
ON DRIVE 1
3ØØ LI$(3)="3= OK - RETURN TO ME
NU a
31Ø PRINT @32Ø,"WORKFILE IS ON D
RIVE ";WF$
32Ø SL=96:NL=3:GOSUB 9ØØØ:ON A G
OTO 33Ø,34Ø,14Ø
33Ø WF$="Ø":GOTO 31Ø
34Ø WF$="1":GOTO 31Ø
35Ø RUN "RETRV
36Ø CLSØ:PRINT "— ADDING INFO
TO DATABASE —e"
37Ø AD=1:LI$(1)="1= ENTER A CHEC
K
38Ø LI$(2)="2= ENTER A DEPOSIT
39Ø LI$(3)="3= ENTER A BILL
4ØØ LI$(4)="4= RETURN TO MENU a
41Ø LI$(5)="5= END THIS SESSION"
:NL=5
42Ø SL=128:GOSUB 9ØØØ:ON A GOTO
5ØØ,8ØØ,1ØØØ,14Ø,23Ø
5ØØ CLSØ:PRINT @Ø,"—  CHECK
INFORMATION ——b
51Ø GOSUB 52Ø:GOSUB 54Ø:GOSUB 56
Ø:GOSUB 58Ø:GOSUB 61Ø:GOTO 63Ø
52Ø P$="1==ENTER THE MONTH:  1-1
2=======":LV=1:HV=12:SL=64
53Ø VT$="N":GOSUB 91ØØ:MM$=RIGHT
$("Ø"+VA$,2):RETURN
```

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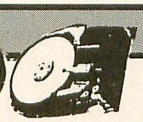

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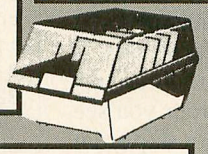

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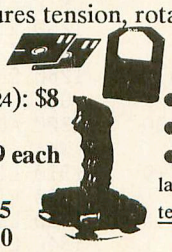

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other. When you have finished, return to the Main menu and switch to adding the next type of record, or exit the program. Of course, if you want to make one big pile of checks, bills and deposits and enter them as they come up, you can alternate between

The DATAB program menus are set up to let you continue to add a single type of record with a minimum of keystrokes.

checks, bills and deposits as you go along. The menus allow you to switch easily from one record type to another.

The details are as follows: When you RUN"DATAB", the first menu is the Main menu — Menu A. Each choice on this menu is made by pressing a number. You do not have to press ENTER after you make your choice. Press the number 1 (add information). You then see Menu E, from which you can select the type of information to add (1=checks, 2=bills or 3=deposits). After you make a choice, a data entry screen appears where you enter the data items that make up the entire record. Each entry is identified by an Item Number. You must enter all of the items in the order you see them on the screen. You cannot skip from Item 1 to Item 3 or go backwards from Item 3 to Item 1. You *can* backspace and retype any item while you are typing it in, and you can change any item you like after all of them have been entered.

To change an item, type its item number. The item is blanked out and you can retype it. When you are finished retyping, press ENTER. Then you will be at the same point you were before. You can either change another item or have the record added to the database. To add the record, press Y. After you press Y, the screen blanks out and the disk drive begins working. If all goes well, a message tells you that the record was added. If there is any problem (for example, the record already exists), the record is not added and you see an error message. In either case you see a menu that allows you to add more records of the same

```
540 P$="2==THE DAY: 1-31 =======
========":LV=1:HV=31:SL=128
550 VT$="N":GOSUB 9100:DD$=RIGHT
$("0"+VA$,2):RETURN
560 P$="3==THE CHECK NUMBER: 100
0-9999==":LV=1000:HV=9999
570 SL=192:VT$="N":GOSUB 9100:CN
$=VA$:RETURN
580 P$="4==THE AMOUNT: NNNNNN.NN
 =======":LV=1.00:HV=999999.99
590 VT$ ="D":SL=256:GOSUB 9100
600 AM$=LEFT$(VA$,LEN(VA$)-3)+RI
GHT$(VA$,2):RETURN
610 P$="5==WHO CHECK WAS PAID TO
 =======":SL=320:VT$="A
620 HV=31:GOSUB 9100:CP$=VA$:RET
URN
630 P$="6==WHAT THE CHECK WAS FO
R =======":SL=384:VT$="A
640 HV=58:GOSUB 9100:CF$=VA$
650 GOSUB 9500
660 IF A$ = "Y" GOTO 690
670 A = VAL(A$):IF A > 0 AND A <
7 GOTO 680 ELSE GOTO 650
680 ON A GOSUB 520,540,560,580,6
10,630:GOTO 650
690 CLS0:PRINT "—— ADDING T
HE CHECK ——"
700 PRINT "     P L E A S E    W
 A I T":OK$= MM$+DD$+"C"+CN$
710 WR$ = OK$+"*"+AM$+SS$+CP$+SS
$+CF$
720 GOSUB 9200:GOSUB 9230:CLS0
730 IF GE =1 THEN PRINT "—  C
HECK WAS ADDED    —dd" ELSE
PRINT "** DUPLICATE CHECK NOT AD
DED **d
740 LI$(1)="1= ADD ANOTHER CHECK
750 LI$(2)="2= ADD OTHER INFORMA
TION
760 LI$(3)="3= RETURN TO MENU a
770 LI$(4)="4= RETRIEVE INFORMAT
ION
780 LI$(5)="5= END THIS SESSION
RIGHT NOW
790 SL=96:NL= 5:GOSUB 9000:ON A
GOTO 500,360,140,350,230
800 CLS0:PRINT "—  DEPOSIT IN
FORMATION  —e
810 GOSUB 520:GOSUB 540:GOSUB 82
0:GOSUB 580:GOTO 840
820 P$="3==A 4-NUMBER DEPOSIT ID
 =======":VT$="N":SL=192
830 LV=1000:HV=9999:GOSUB 9100:D
C$=VA$:RETURN
840 P$="5==THE SOURCE OF FUNDS =
=========":SL=320:HV=64:VT$="A
850 GOSUB 9100:SF$=VA$
860 GOSUB 9510
870 IF A$ = "Y" GOTO 900
880 A = VAL(A$):IF A > 0 AND A <
6 GOTO 890 ELSE GOTO 860
890 IF A=5 GOTO 840 ELSE ON A GO
SUB 520,540,820,580:GOTO 860
900 GOSUB 9200:WR$=MM$+DD$+"D"+D
C$+"*"+AM$+SS$+SF$+SS$
910 OK$ = LEFT$(WR$,9):CLS0:PRIN
T "—  DEPOSIT BEING ADDED --
-";
920 PRINT @32,"   P L E A S E
  W A I T ":GOSUB 9230
930 CLS0:IF GE=1 THEN PRINT "--
-  DEPOSIT WAS ADDED —ff" E
LSE PRINT "*** DUPLICATE DEPOSIT
 NOT ADDED
940 LI$(1)="1= ADD MORE DEPOSITS
950 LI$(2)="2= ADD OTHER INFORMA
TION
960 LI$(3)="3= RETURN TO MENU a
970 LI$(4)="4= RETRIEVE INFO FRO
M DATABASE
980 LI$(5)="5= END THIS SESSION
RIGHT NOW
990 NL=4:SL=128:GOSUB 9000:ON A
GOTO 800,360,140,350,230
1000 CLS0:PRINT "— BILL TO PAY
INFORMATION —":FR=0
1010 GOSUB 1020:GOSUB 1040:GOSUB
 1060:GOSUB 580:GOSUB 1080:GOTO
1100
1020 P$="1==ENTER THE BILL DUE M
ONTH:1-12":VT$="N
1030 SL=64:LV=1:HV=12:GOSUB 9100
:MM$=RIGHT$("0"+VA$,2):RETURN
1040 P$="2==THE BILL DUE DAY: 1-
31 =======":VT$="N
1050 SL=128:LV=1:HV=31:GOSUB 910
0:DD$=RIGHT$("0"+VA$,2):RETURN
1060 P$="3==A 4-NUMBER ID CODE =
==========":VT$="N
1070 SL=192:LV=1000:HV=9999:GOSU
B 9100:BN$=VA$:RETURN
1080 P$="5==PAY THE BILL TO? ===
==========":VT$="A
1090 SL=320:HV=31:GOSUB 9100:BT$
=VA$:RETURN
1100 P$="6==THE REASON FOR THE B
ILL? ====":VT$="A
1110 SL=384:HV=64:GOSUB 9100:BP$
=VA$
1120 GOSUB 9500
1130 IF A$= "Y" GOTO 1160
1140 A = VAL(A$):IF A > 0 AND A
<7 GOTO 1150 ELSE GOTO 1120
1150 IF A=6 GOTO 1100 ELSE ON A
GOSUB 1020,1040,1060,580,1080:GO
TO 1120
1160 WR$=MM$+DD$+"B"+BN$+"*"+AM$
+SS$+BT$+SS$+BP$
1170 CLS0:PRINT "— BILL BEIN
G ADDED ———"
1180 PRINT      "    P L E A S E
    W A I T
1190 GOSUB 9200:OK$ = LEFT$(WR$,
9):GOSUB 9230
1200 CLS0:IF GE=1 THEN PRINT "-
—  BILL WAS ADDED  ——g"
ELSE PRINT "*** DUPLICATE FOUND
- NOT ADDED ";
1210 LI$(1)="1= ADD MORE BILLS
1220 LI$(2)="2= ADD OTHER INFORM
ATION
1230 LI$(3)="3= RETURN TO MENU a
1240 LI$(4)="4= RETRIEVE INFO FR
OM DATABASE
1250 LI$(5)="5= END THIS SESSION
 RIGHT NOW
1260 SL= 96:NL=5:GOSUB 9000:ON A
 GOTO 1000,360,140,350,230
1300 AD=3:CLS0:PRINT @0,"—
 WHAT TO DELETE    —h
1310 LI$(1)="1= DELETE A CHECK
1320 LI$(2)="2= DELETE A DEPOSIT
1330 LI$(3)="3= DELETE A BILL
1340 LI$(4)="4= RETURN TO MENU a
1350 LI$(5)="5= END THIS SESSION
":NL=5:SL=96:GOSUB 9000
1360 ON A GOTO 1370,1390,1380,14
0,230
1370 OK$ = "C":DV$=" CHECK ":GOT
O 1400
1380 OK$ = "B":DV$=" BILL ":GOTO
 1400
1390 OK$ = "D":DV$=" DEPOSIT
```

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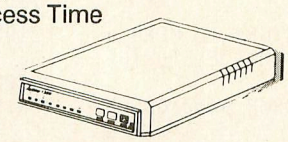

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type or to return to the previous menu to make another selection. Depending upon the type of record being added, this menu code is either C, GG or FF. When you have finished adding all of the information, return to the main menu and make a choice from there. Remember, you can chain directly to RETRV from the main menu if you want to run reports.

Helpful Hints

You should set up a numbering scheme for your records. Each check, bill or deposit must be identified by a four-number identification code. For checks this can be the actual check number in your checkbook, or it can be a code number you create if you don't have a checkbook. For bills and deposits you must also create your own number. It is easy if you start the first bill and deposit of each month with the month number, a zero or two, then the number 1 and proceed from there. You can use any numbering scheme you like. It is helpful to write the number directly on the bill and deposit slip.

It is easy if you start the first bill and deposit of each month with the month number, a zero or two, then the number 1 and proceed from there.

If you want to cross-reference checks and bills, place the code number of the bill in the PURPOSE field of the check record(s) that paid it. When you first enter the bill and the check, place the same name in the From field of the bill that you put in the To field of the check.

Changing and Deleting Information

To change or delete information already in the database, RUN "DATAB". On the first menu (Menu A) you can choose either Item 2 (Change) or Item 3 (Delete). Make your choice by pressing that number. If you choose Change, the next menu is Menu I. If you choose Delete, the next menu is Menu H. On these menus you are asked to provide the record type with which you want to work. There are also exiting options for ease of use. Once you have indicated the

```
1400 CLS0:PRINT @0,"—  FIND T
HE";DV$;" —":PRINT @25,"—-
k";
1410 SL=96:P$="1= ENTER"+DV$+"NU
MBER: 1000-9999
1420 VT$="N":LV=1000:HV=9999:GOS
UB 9100:SN$=VA$
1430 SL=160:P$="2= ENTER"+DV$+"M
ONTH: 1-12
1440 VT$="N":LV=1:HV=12:GOSUB 91
00
1450 MM$=RIGHT$("0"+VA$,2)
1460 SL=224:P$="= ENTER"+DV$+"DA
Y: 1-31
1470 VT$="N":LV=1:HV=31:GOSUB 91
00
1480 DD$=RIGHT$("0"+VA$,2):GOSUB
 9200
1490 OK$=MM$+DD$+OK$+SN$:GOSUB 9
230:IF GE=2 GOTO 1620 ELSE CLS0
1500 PRINT @0,"— THE RECORD
WAS FOUND —j
1510 LI$(1)="1= DELETE A DIFFERE
NT RECORD
1520 LI$(2)="2= RETURN TO THE FI
RST MENU a
1530 LI$(3)="3= DISPLAY RECORD T
O BE DELETED
1540 LI$(4)="4= ** GO DELETE THE
 RECORD **
1550 LI$(5)="5= END THIS SESSION
1560 SL=96:NL=5:GOSUB 9000
1570 ON A GOTO 1300,140,1680,158
0,230
1580 RA=1:CLS0:PRINT "— RECO
RD BEING DELETED —"
1590 PRINT "     P L E A S E
W A I T":GOSUB 9230
1600 CLS0:IF GE=1 THEN PRINT @0,
"+++++ THE RECORD WAS DELETED ++
+++" ELSE GOTO 1620
1610 GOTO 1630
1620 CLS0:PRINT @0,"* RECORD NOT
 FOUND & NOT DELETED
1630 LI$(1)="1= DELETE ANOTHER R
ECORD
1640 LI$(2)="2= RETURN TO MENU a
1650 LI$(3)="3= RETRIEVE FROM TH
E DATABASE
1660 LI$(4)="4= END THIS SESSION
1670 SL=96:NL=4:GOSUB 9000:ON A
GOTO 1300,140,350,230
1680 CLS0:PRINT "- DISPLAY RECOR
D TO BE DELETED -
1690 LI$(1)="1= RETURN TO THE LA
ST MENU
1700 LI$(2)="2= RETURN TO MENU a
1710 LI$(3)="3= ** GO DELETE THE
 RECORD **
1720 SL=96:NL=3:GOSUB 9400:GOSUB
 9000
1730 ON A GOTO 1400,140,1580
1800 AD=2:CLS0:PRINT @0,"——
  WHAT TO CHANGE? ——i";
1810 LI$(1)="1= CHANGE A CHECK
1820 LI$(2)="2= CHANGE A DEPOSIT
1830 LI$(3)="3= CHANGE A BILL
1840 LI$(4)="4= RETURN TO FIRST
MENU a
1850 LI$(5)="5= RETRIEVE INFORMA
TION
1860 LI$(6)="6= END THIS SESSION
"
1870 NL=5:SL=96:GOSUB 9000
1880 CLS0:ON A GOTO 1890,1910,19
00,140,350,230
1890 OK$ = "C":DV$=" CHECK ":GOT
O 1920
1900 OK$ = "B":DV$=" BILL ":GOTO
 1920
1910 OK$ = "D":DV$=" DEPOSIT
1920 PRINT @27,"—";:PRINT @0
,"- FIND THE";DV$;"TO CHANGE ";
1930 SL=96:P$="1= ENTER THE NUMB
ER: 1000-9999
1940 VT$="N":LV=1000:HV=9999:GOS
UB 9100
1950 SN$=VA$:SL=160:P$="2= ENTER
"+DV$+"MONTH: 1-12
1960 VT$="N":LV=1:HV=12:GOSUB 91
00
1970 MM$=RIGHT$("0"+VA$,2)
1980 SL=224:P$="3= ENTER"+DV$+"D
AY: 1-31
1990 VT$="N":LV=1:HV=31:GOSUB 91
00
2000 DD$=RIGHT$("0"+VA$,2):GOSUB
 9200
2010 OK$=MM$+DD$+OK$+SN$:GOSUB 9
230:IF GE=2 GOTO 2420
2020 CLS0:PRINT @0,"- CHANGE (1-
4) THEN ACT (5-7) -j
2030 LI$(1)="1= CHANGE"+DV$+"AMO
UNT"
2040 LI$(2)="2= CHANGE CLEARED I
NDICATOR
2050 LI$(3)="3= CHANGE"+DV$+"PAI
D TO"
2060 LI$(4)="4= CHANGE CHECK OR
BILL PURPOSE
2070 LI$(5)="5= DISPLAY INFO NOW
 IN RECORD
2080 LI$(6)="6= MAKE NO CHANGES-
START AGAIN
2090 LI$(7)="7= CHANGES COMPLETE
D- MAKE THEM
2100 NL=7:SL=96:GOSUB 9000
2110 ON A GOTO 2130,2190,2240,23
30,2480,2120,2390
2120 CLOSE:GOTO 1800
2130 PRINT @352,"OLD AMOUNT WAS:
 ";:I=INSTR(11,LI$,SS$)
2140 AM$=MID$(LI$,11,I-11):AM$=L
EFT$(AM$,LEN(AM$)-2)+"."+RIGHT$(
AM$,2)
2150 PRINT USING "$#######.##";VA
L(AM$)
2160 P$="ENTER NEW AMOUNT BELOW"
:SL=384:LV=1:HV=999999.99
2170 VT$="D":GOSUB 9100:AM$=LEFT
$(VA$,LEN(VA$)-3)+RIGHT$(VA$,2)
2180 LI$=LEFT$(LI$,10)+AM$+RIGHT
$(LI$,LEN(LI$)-I+1):GOTO 2020
2190 PRINT @352,"CLEARED/PAID WA
S: ";MID$(LI$,10,1);
2200 IF MID$(LI$,10,1)=" " THEN
PRINT " = YES" ELSE PRINT " = NO
"
2210 P$="ENTER ' ' OR '*' BELOW"
:SL=384:VT$="A":HV=1
2220 GOSUB 9100:IF VA$ <> " " AN
D VA$ <> "*" THEN GOTO 2210
2230 MID$(LI$,10,1)=VA$:GOTO 202
0
2240 PRINT @352,"PAID TO WAS: ";
2250 I=INSTR(11,LI$,SS$):J=INSTR
(I+1,LI$,SS$)
2260 IF MID$(LI$,I,1)=CHR$(127)
GOTO 2270 ELSE NEXT I
2270 CP$ = MID$(LI$,I+1,J-I-1)
2280 PRINT CP$:P$="ENTER NEW PAY
 TO BELOW
2290 IF (J-I-1) > 20 THEN SL=416
 ELSE SL=384
```

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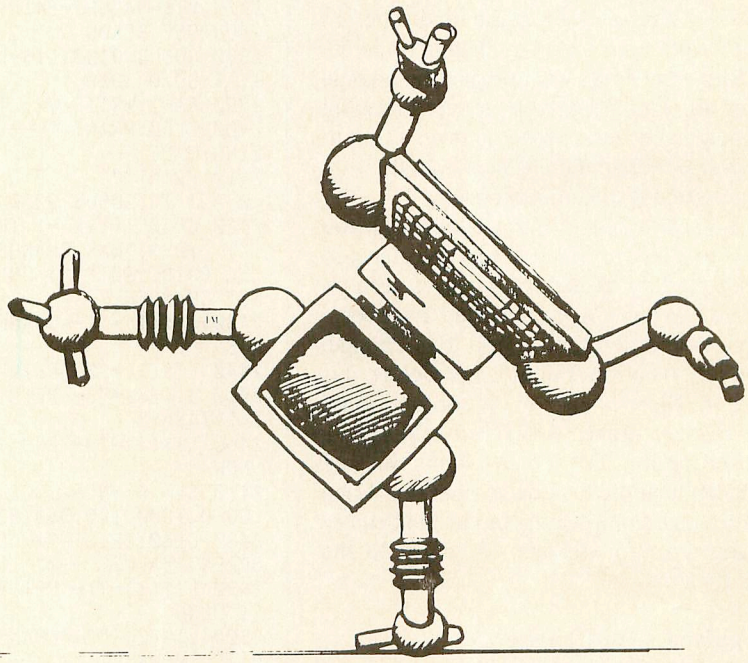

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record type, you are asked to supply the identification number of the record and the *month* and day of the transaction. The program then attempts to find the record. If it cannot, you will see an error message and you can try again. If it can, you are under the control of Menu J. If you have forgotten the identification number, day or date, Menu I lets you directly run RETRV to help find it.

Menu J is different for change and delete, but in both cases there are two features in common: These are Preview and Action. Preview lets you look at the record before you finally take action to change or delete it. You can decide not to make the change after all. This helps you to avoid making mistakes, because once you take action to change or delete there is no automatic way to get the old information back.

You can make as many changes as you want to a record. Each item to be changed is selected by its item number, as seen on Menu J. When you are satisfied that everything is in order, take action. For Change, the Action option is Item 7. For Delete, it is Item 4. There is also an Action option on the display menu. After you choose the Action option, the screen blanks out and you can hear the disk drive operate. When the action is completed, you can make more changes and/or deletes, or return to the Main menu.

Regular Use of Change

To keep information current, you must update records on a regular basis. The first item to update is the Cleared field. Updating this item to a space means it has cleared the account. A cleared check is one that has been paid; the funds are no longer yours. A cleared deposit means you have the funds in your account and can use them. A cleared bill is one that has been totally paid. When you add a record to the database, it automatically goes in as Not Cleared. Once you find that the status has changed, you should change the record from Not Cleared to Cleared. Not Cleared records have an asterisk (*) in the data field; Cleared records have a space. If you make a mistake, don't worry. You can change it back.

Deleting Records

Once you delete a record, it is removed from the database, and you cannot get it back unless you re-enter it. There are some databases that have an undo delete capability, but the one presented here is not one of them. Be careful to use the preview feature to make sure the record to be deleted is really the one you want to delete.

In Part V I'll present a discussion of and listing for RETRV. Then I'll finish the series with some ideas regarding commercial database software. ❑

```
2300 VT$="A":HV=31:GOSUB 9100
2310 LI$ = LEFT$(LI$,I)+VA$+RIGH
T$(LI$,LEN(LI$)-J+1)
2320 GOTO 2020
2330 IF LEFT$(DV$,2)=" D" GOTO 2
100 ELSE PRINT @352,"PURPOSE WAS
:";
2340 I= INSTR(11,LI$,SS$):J=INST
R(I+1,LI$,SS$)
2350 CF$ = MID$(LI$,J+1,LEN(LI$)
-J)
2360 PRINT CF$:IF (LEN(LI$)-J) >
 21 THEN SL=416 ELSE SL=384
2370 VT$="A":HV=64:P$="ENTER NEW
 PURPOSE BELOW
2380 GOSUB 9100:LI$=LEFT$(LI$,J)
+VA$:GOTO 2020
2390 RA=1:WRITE #2,LI$
2400 CLS0:PRINT "—— CHANGE B
EING MADE ——"
2410 PRINT "     P L E A S E
 W A I T":GOSUB 9230
2420 CLS0:IF GE =1 THEN PRINT @0
,"— ";DV$;"WAS CHANGED —" E
LSE PRINT @0,"*** UNFOUND";DV$;"
NOT CHANGED
2430 LI$(1)="1= CHANGE MORE RECO
RDS
2440 LI$(2)="2= RETURN TO MENU a
2450 LI$(3)="3= RETRIEVE FROM TH
E DATABASE
2460 LI$(4)="4= END THIS SESSION
 NOW
2470 SL= 96:NL=4:GOSUB 9000:ON A
 GOTO 1800,140,350,230
2480 CLS0:PRINT "++ DISPLAY OF C
URRENT VALUES ++m"
2490 LI$(1)="1= RETURN TO THE LA
ST MENU
2500 LI$(2)="2= CHANGE THE RECOR
D AS SHOWN
2510 SL=96:NL=2:GOSUB 9400:GOSUB
 9000:ON A GOTO 2020,2390
9000 FOR I= 1 TO NL:PRINT @SL,LI
$(I)
9007 SL= SL+32:NEXT I
9014 PRINT @32,"*   SELECT FROM
THE FOLLOWING
9021 FOR I = 1 TO 200
9028 A$ = INKEY$:IF A$ <> "" GOT
O 9056 ELSE NEXT I
9035 PRINT @32," ":FOR I = 1 TO
65
9042 A$ = INKEY$:IF A$ <> "" GOT
O 9056 ELSE NEXT I
9049 GOTO 9014
9056 A = VAL(A$):IF A > 0 AND A
< NL+1 THEN RETURN
9063 GOTO 9014
9100 PRINT @SL,P$ :PRINT @SL+32,
" "
9107 PRINT @SL+32,"";
9114 LINE INPUT " >";VA$
9121 LA= LEN(VA$):IF VT$ = "D" G
OTO 9177
9128 IF VT$ = "N" GOTO 9149
9135 IF LA > HV GOTO 9100
9142 RETURN
9149 VV= VAL(VA$):IF VV < LV OR
VV > HV GOTO 9100
9156 IF VT$="D" GOTO 9142
9163 IF RIGHT$(VA$,1)< "0" OR RI
GHT$(VA$,1)> "9" GOTO 9100
9170 IF VV <> INT(VV) GOTO 9100
ELSE GOTO 9142
9177 IF LA > 9 OR LA < 3 GOTO 91
00
9184 IF MID$(VA$,LA-2,1) <> "."
GOTO 9100
9191 GOTO 9149
9200 IF DD$ > "15" THEN DF$ = "1
5" ELSE DF$ = "01
9210 SG$= "M"+ MM$+ "D"+ DF$+ "/
CHK"
9220 CLOSE:OPEN "I",#1,SG$:OPEN
"O",#2,"WORK/CHK:"+WF$:RETURN
9230 IF EOF(1) = -1 GOTO 9270
9240 INPUT #1,LI$:IK$ = LEFT$(LI
$,9)
9250 IF IK$< OK$ THEN WRITE #2,L
I$ ELSE GOTO 9310
9260 GOTO 9230
9270 ON RA GOTO 9290:ON AD GOTO
9280,9300,9300
9280 WRITE #2,WR$
9290 RA=0:CLOSE:KILL SG$:COPY "W
ORK/CHK:"+WF$ TO SG$:GE=1:RETURN
9300 RA=0:GE=2:CLOSE:RETURN
9310 IF IK$ > OK$ GOTO 9340: 'IN
PUT >=OUTPUT
9320 ON AD GOTO 9300,9330,9330
'INPUT =OUTPT
9330 GE=1:RETURN 'CHANGE
9340 ON AD GOTO 9350,9370,9370:
'INPUT > OUTPUT
9350 ON RA GOTO 9360:WRITE #2,WR
$:WRITE #2,LI$:RA=1:GOTO 9230
9360 WRITE #2,LI$:GOTO 9230
9370 ON RA GOTO 9360:GOTO 9300
9400 PRINT @256,"==== THE CURREN
T RECORD IS =====";
9407 PRINT DV$;"NUMBER:";MID$(LI
$,6,4);
9414 PRINT "  DATE:";LEFT$(LI$,2
);"/";MID$(LI$,3,2)
9421 I=INSTR(11,LI$,SS$):J=INSTR
(I+1,LI$,SS$)
9428 AM$=MID$(LI$,11,I-11):AM$=L
EFT$(AM$,LEN(AM$)-2)+ "." +RIGHT
$(AM$,2)
9435 PRINT @320," AMOUNT:";:PRIN
T USING "$$######.##";VAL(AM$)
9442 PRINT " CLEARED:";MID$(LI$,
10,1)
9449 PRINT " TO/FROM:";MID$(LI$,
I+1,J-I-1)
9456 IF LEFT$(DV$,2)=" D" THEN R
ETURN
9463 PRINT " PURPOSE:";RIGHT$(LI
$,LEN(LI$)-J):RETURN
9500 JF=384:JB=1:GOTO 9520
9510 JF=320:JB=2
9520 PRINT @0,"-  FINAL O.K.
OR CHANGE —c
9530 PRINT @32," TYPE 'Y' IF ALL
 ITEMS ARE O.K.
9540 FOR J=64 TO JF STEP 64:PRIN
T @J,"=";
9550 PRINT @J+32," ";:NEXT J
9560 FOR I = 1 TO 350
9570 A$=INKEY$:IF A$ <> "" GOTO
9640 ELSE NEXT I
9580 PRINT @32,PM$;:PRINT @96,"1
";:PRINT @160,"2";
9590 PRINT @224,"3";:PRINT @288,
"4";:PRINT @352,"5";
9600 ON JB GOTO 9610,9620
9610 PRINT @416,"6";
9620 FOR I=1 TO 450
9630 A$=INKEY$:IF A$ <> "" GOTO
9640 ELSE NEXT I:GOTO 9530
9640 RETURN
```

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A way to speed up routines in ROM using complex math

The Assembly Line

Part I: Scaling Mt. Mandelbrot

by William P. Nee

I received many letters concerning my series "Machine Language Made BASIC" (RAINBOW, July 1988 through July 1989). Many readers asked about machine language routines and offered suggestions for future articles. As a result, I've written some new articles on different ways to do old routines. Since most of the questions I received concerned ways to speed up routines already in ROM, such as the LINE command, as well as ways to improve BASIC Mandelbrot programs, I decided to combine that with a new way to do the math required in these projects.

For persons unfamiliar with the Mandelbrot set (named for Professor Benoit Mandelbrot), it is a stunning visual display of fractal geometry. Although the entire set fits into a 2½-by-2-unit area, any part of the set can be magnified indefinitely for greater detail — a property of most fractals.

The mathematics involved in computing the Mandelbrot set is the squaring of a complex number with real and imaginary parts. Imaginary numbers are those that include *i*, the square root of -1. Examples of a complex number are 3+2*i* and 0+5*i*. If you designate a complex number as *z*, then its parts are *x*+*yi*. z^2 is (*x*+*yi*)*(*x*+*yi*) or *x***x*+2*xyi*+*yi***yi*; but since *i* is the square root of -1, *yi***yi*=-*y***y* so *z* squared is *x***x*-*y***y*+2*xyi*. The new real part of *z* squared is then *x***x*-*y***y*, and the new imaginary part is 2*xyi*. The difference between just squaring *z* and the Mandelbrot set is that the Mandelbrot set keeps adding the *x* and *yi* values to the new computed real and imaginary values, so the new *z* equals *z***z*+*x*+*yi*. One other important concept is that the value of a complex number is the square root of (*x***x*+*y***y*). The value, for example, of 3+4*i* is 5. I'll discuss the value more a little later.

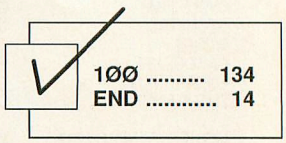
How do you determine if a number is within the Mandelbrot set, and how do you graphically display this? First square the complex number and add the original complex number to the result. When this is done long enough, most complex numbers become too large for the CoCo to handle. One of the major theorems of fractals states that if a complex number's value ever exceeds 2, it must eventually keep getting larger and is therefore not in the Mandelbrot set. Since computing the square root of a number to find its value is fairly time-consuming, compare the value squared to 4; that is, if *x***x*+*y***y*>4, then the number must be outside the set. But how long do you keep checking for this?

Each run through the math is called an *iteration*. The number of iterations used depends on your patience. The higher the count, the more precise the display will be but the longer it will take. Generally a count of 255 gives you 95-percent accuracy, but you can go as low as 25 for a rough idea of what an area looks like.

To plot the number, square the result and add the original number. Keep doing this until one of two things happens: The value of the number squared becomes greater than four, or you reach the predetermined iteration count. Those numbers that finally reach the count are plotted in the same color; those numbers that exceed four are plotted by using a color scheme based on the number of iterations it took to reach four. These latter numbers are the most visual part of the display.

The grid used to explore the Mandelbrot set consists of the normal horizontal *x*-axis

64K Disk



Listing 1: SCALE1

```
Ø ' COPYRIGHT 199Ø FALSOFT, INC
1Ø XC=-1.5:XD=2:XS=XD/64
2Ø YC=-1.Ø:YD=2:YS=YD/64
3Ø PMODE3,1:PCLS:SCREEN1,Ø
4Ø X=XC:FOR H=Ø TO 64
5Ø Y=YC:FOR V=Ø TO 64
6Ø A=X:B=Y
7Ø FOR C=Ø TO 5Ø
8Ø IF A*A+B*B>4 THEN 2ØØ
9Ø AA=A*A-B*B+X
1ØØ BB=2*A*B+Y
11Ø A=AA:B=BB
12Ø NEXT:PSET(H+H,191-V,8)
13Ø Y=Y+YS:NEXT V
14Ø X=X+XS:NEXT H
15Ø GOTO 15Ø
2ØØ 'COLOR SCHEME
21Ø IF C<11 THEN 13Ø
22Ø IF C<16 THEN PSET(H+H,191-V,
7):GOTO 13Ø
23Ø PSET(H+H,191-V,6):GOTO 13Ø
```

Bill Nee bucked the "snowbird" trend by retiring to Wisconsin from a banking career in Florida. He spends the long, cold winters writing programs for his CoCo. He can be contacted at Rt. 2, Box 216C, Mason, WI 54856-9302.

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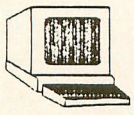

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and an imaginary vertical *y*-axis. Pick the lower left corner where you want to start exploring and decide on the distances you will travel right and up to reach the upper right corner. All points within this rectangle are checked and plotted. Since you are using a complex grid, the lower left corner represents the initial complex number, *z*.

Let's start by looking at a three-color display of the entire Mandelbrot set and then review how to do the math. Since you'll be looking at the entire set, make the left limit (XC) -1.5 (you can actually use -2, but there's very little out there to see), the right limit +5, the bottom limit (YC) -1, and the top limit +1. The lower-left corner is -1.5-1*i* and is also *z*. Rather than use the full screen for now plot everything inside a 64-by-64 rectangle. The horizontal distance is +.5-(-1.5) or 2(XD) so each point is 2/64 (XS) apart horizontally. The vertical distance is +1-(-1) or 2(YD), so again each point will be 2/64 (YS) apart vertically.

Once the initial point is checked and plotted, continue moving up one step (YS) until you reach the top; then from the starting point, move one step to the right (XS) and go all the way to the top, checking and plotting each point. Keep doing this until every point in the rectangle is checked and plotted. Use an iteration count of 50 to speed up the process.

Those numbers that are part of the Mandelbrot set are PSET with Color 8; those with an iteration count between 16 and 50 are PSET with Color 6; those with a count between 15 and 11 are PSET with Color 7; and numbers with a count below 11 are ignored. Again, those points that don't quite make the Mandelbrot set give the display the most color and visual effect. Try any different color values and iteration count to see how the image changes.

Type in and run Listing 1. You might want to save it as your basic Mandelbrot program. Notice that the Mandelbrot set is symmetrical around its *x* (real) axis. The program takes long enough to run even with a fairly low iteration count and comes nowhere near to filling the entire screen. The computer can handle the math, but the iterations just take too long. (It looks as if it's machine language to the rescue!) I first developed a program that followed the BASIC program exactly, using all the built-in floating point routines in ROM. While this was a little faster, it still wasn't very satisfactory. I then tried converting all numbers to hexadecimal, using my own multiplication routine. Have you ever tried to convert -.0811279 to Hex? So I discarded that idea also. What was needed was a brand-new approach.

Another program I had been working on

Listing 2: SCALEMAN

```
00100          ORG     $6000
00110 START    LDD     #-12288 DUMMY COORDINATES
00120          STD     XC
00130          LDD     #-8192  DUMMY COORDINATES
00140          STD     YC
00150          LDD     #128    DUMMY STEP
00160          STD     XS
00170          LDD     #85     DUMMY STEP
00180          STD     YS
00190
00200          LDD     XC
00210          STD     XLOC
00220          CLRB
00230 ML1      STB     ACROSS
00240          LDD     YC
00250          STD     YLOC
00260          CLRA
00270 ML2      STA     DOWN
00280          LDD     XLOC
00290          STD     ALOC    TEMPORARY LOCATION
00300          LDD     YLOC
00310          STD     BLOC    TEMPORARY LOCATION
00320
00330          CLRB
00340 AGAIN    STB     COUNT
00350          LDD     ALOC
00360          BPL     CONT1   IS IT NEGATIVE?
00370          NEGA            IF SO -
00380          NEGB             NEGATE IT
00390          SBCA    #0
00400 CONT1    TFR     D,X
00410          JSR     $9FB5   D*X->Y+U
00420          STY     ASQ1
00430          STU     ASQ3
00440          LDD     BLOC
00450          BPL     CONT2   IS IT NEGATIVE?
00460          NEGA            IS SO -
00470          NEGB             NEGATE IT
00480          SBCA    #0
00490 CONT2    TFR     D,X
00500          JSR     $9FB5   D*X->Y+U
00510          STY     BSQ1
00520          STU     BSQ3
00530 GETSUM   LDD     ASQ3
00540          ADDD    BSQ3
00550          LDA     ASQ2
00560          ADCA    BSQ2
00570          LDA     ASQ1
00580          ADCA    BSQ1
00590 TEST     CMPA    #$10    COMPARE TO MSB OF 2**13TH
00600          BLO     GETDIF  STILL A VALID NUMBER
00610          LDB     COUNT
00620          CMPB    #9
00630          LBLS    FIN
00640          LDU     #CTABLE
00650          LDB     B,U     COLOR BASED ON ITERATIONS
00660          LBRA    PSET
00670 GETDIF   LDD     ASQ3
00680          SUBD    BSQ3
00690          STD     DIF3
00700          LDA     ASQ2
00710          SBCA    BSQ2
00720          STA     DIF2
00730          LDA     ASQ1
00740          SBCA    BSQ1
00750          STA     DIF1
00760          LDB     #13     SCALE FACTOR IS 2**13TH
00770 SCALE1   ASR     DIF1
00780          ROR     DIF2
00790          ROR     DIF3
00800          ROR     DIF4
00810          DECB
00820          BNE     SCALE1
00830          LDD     DIF3    RESULT
```

involved packing and unpacking large numbers for disk storage. Most of the numbers were multiplied by a power of two so that a few bytes could represent a lot of numbers. Could this procedure also work in the Mandelbrot program? Yes, with some modification it can. The good news is that it's a lot faster; the bad news is that you sacrifice accuracy, but for enlarged areas you probably won't notice this.

The Mandelbrot set (named for Professor Benoit Mandelbrot), is a stunning visual display of fractal geometry.

The trick is to scale all the numbers as you go along and multiply everything by a large enough factor so you don't have decimals to worry about. In this way you can avoid floating point math and make use of quicker multiplication routines. After a lot of experimenting, the largest scale factor I found I could use was 8192 — 2^{13}. With this factor all numbers can be expressed using two bytes each.

Take a look at the BASIC program (Listing 3). It reads all four coordinates and scales each one (lines 50 and 60), then computes the distances and steps — each step must be between 1 and 255. If either part of *z* is negative, it is converted to a negative Hex value by subtracting from $FFFF and adding 1 (lines 110 and 150). The beginning coordinates and steps are poked into the machine language program. Finally the desired color scheme is poked in (Color 4/6 is 255, Color 3/7 is 170, Color 2/6 is 85 and Color 1/5 is 0). The regular color scheme is:

Count	Color
below 10	ignored
10,12,14,16,18	Color 4/8
11,13,15,17	Color 3/7
19-25	Color 1/5
26-69	Color 2/6
69-end	Color 3/7

I've also included a seven-color logarithmic color scheme:

Count	Color
0-22	ignored
23-26	Color 2/6
27-34	Color 3/7
35-49	Color 2/6
50-78	Color 3/7
79-136	Color 2/6
137-end	Color 3/7

You can change the low count (10) and the high count (255) in Line 210; the high count cannot exceed 255.

Now follow the machine-language program in Listing 2. The original *x* corner and *y* corner are loaded into temporary XLOC and YLOC and also ALOC and BLOC variables. Next the value in ALOC is checked to see if it's negative; if so, it's made positive, then multiplied by itself and stored in ASQ1 through ASQ4. The BLOC value is then checked, multiplied by itself and stored in BSQ1 through BSQ4. The two squares are added together for comparison with 4. Since originally you would have been comparing these squares with 2*SCALE, you now must compare against 2*SCALE squared or 4*SCALE*SCALE; in Hex that's $10000000. All you really need to check is the left byte of the sum to see if it's more than $10. If it is greater than $10, it's greater than 4; that

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point is loaded with the color value corresponding to the iteration count and PSET.

If the sum of the squares is less than 4, you need the difference of them since A*A-B*B is part of the real number. The squares are subtracted and stored in DIF1 through DIF4. Again this number is too large; what you really have is the difference multiplied by the square of SCALE. You only want *difference**SCALE, so divide this number by SCALE. As I mentioned, SCALE is 2^{13}, so 13 shifts to the right divides the difference; the result is in DIF3 through DIF4. Finally the old XLOC is added to this and the new real number is temporarily stored in DIF1 and DIF2.

To get the new imaginary part of *z*, multiply ALOC and BLOC, and keep track of their signs. When you were squaring them earlier, the result had to be positive, but now it can be either positive or negative. If you EOR (exclusively OR) the first byte of each number, the result is positive if their signs are alike and negative if they are different. Save the result. Next check both numbers, negate them if they are negative, multiply them, and store the result (just for convenience) in SUM1 through SUM4. Get the sign for this number and negate the number if necessary.

The trick is to scale all numbers so you can avoid floating point math and make use of quicker multiplication routines.

Why not multiply this by 2 now, since part of your imaginary number is 2*A*B? Since this number is also too large and will have to be divided by SCALE, why multiply by 2 and then divide by 2^{13} power? Simply divide by 2^{12} to get the same result. You need only 12 shifts to the right, and the result is in SUM3 through SUM4. Add to this the old YLOC and store the result in BLOC; get the new ALOC from DIF1 and DIF2 and store it in ALOC. The new value, properly scaled, is in ALOC and BLOC. Increase the count and, if it hasn't reached the maximum count of 255, start the whole process over again. If the count is reached, that value is in the Mandelbrot set so PSET the point in Color 7.

```
00840          ADDD    XLOC
00850          STD     DIF1     NEW REAL VALUE
00860
00870          LDA     ALOC
00880          EORA    BLOC
00890          STA     SIGN     SIGN OF THE PRODUCT
00900          LDD     ALOC
00910          BPL     CONT4    IS IT NEGATIVE?
00920          NEGA             IS SO -
00930          NEGB              NEGATE IT
00940          SBCA    #0
00950 CONT4    TFR     D,X       AND SAVE IT
00960          LDD     BLOC
00970          BPL     CONT5    IS IT NEGATIVE?
00980          NEGA             IS SO -
00990          NEGB              NEGATE IT
01000          SBCA    #0
01010 CONT5    JSR     $9FB5    D*X->Y+U
01020          STY     SUM1
01030          STU     SUM3
01040          TST     SIGN     IS PRODUCT NEGATIVE?
01050          BPL     CONT6
01060          COM     SUM1     IS SO -
01070          COM     SUM2      NEGATE IT
01080          COM     SUM3
01090          COM     SUM4
01100          LDB     SUM4
01110          ADDB    #1
01120          STB     SUM4
01130          LDA     SUM3
01140          ADCA    #0
01150          STA     SUM3
01160          LDB     SUM2
01170          ADCB    #0
01180          STB     SUM2
01190          LDA     SUM1
01200          ADCA    #0
01210          STA     SUM1
01220 CONT6    LDB     #12      NEW SCALE IS 2**12TH
01230 SCALE2   ASR     SUM1
01240          ROR     SUM2
01250          ROR     SUM3
01260          ROR     SUM4
01270          DECB
01280          BNE     SCALE2
01290          LDD     SUM3
01300          ADDD    YLOC
01310          STD     BLOC     NEW IMAGINARY VALUE
01320          LDD     DIF1
01330          STD     ALOC     NEW REAL VALUE
01340          LDB     COUNT
01350          INCB
01360          CMPB    #255
01370          LBNE    AGAIN
01380          LDB     #$FF     MANDELBROT SET POINT
01390 PSET     STB     $B5
01400          LDA     #191     ADJUST FOR SCREEN
01410          SUBA    DOWN
01420          LDB     $B9      BYTES ACROSS
01430          MUL
01440          ADDA    $BA      START OF PAGE1
01450          TFR     D,X
01460          LDB     ACROSS
01470          LSRB
01480          LSRB
01490          ABX
01500          LDA     ACROSS
01510          ANDA    #3
01520          LDU     #$92E5   PMODE3 OR TABLE
01530          LDA     A,U
01540          ANDA    $B5
01550          ORA     ,X
01560          STA     ,X
01570
01580 FIN      LDD     YLOC
01590          ADDD    YS       NEXT POINT UP
```

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```
01600          STD     YLOC
01610          LDA     DOWN
01620          INCA
01630          CMPA    #191
01640          LBLS    ML2
01650
01660          LDD     XLOC
01670          ADDD    XS      NEXT POINT OVER
01680          STD     XLOC
01690          LDB     ACROSS
01700          INCB
01710          CMPB    #127
01720          LBLS    ML1
01730          RTS
01740 XC       RMB     2
01750 YC       RMB     2
01760 XS       RMB     2
01770 YS       RMB     2
01780 XLOC     RMB     2
01790 YLOC     RMB     2
01800 ALOC     RMB     2
01810 BLOC     RMB     2
01820 COUNT    RMB     1
01830 ASQ1     RMB     1
01840 ASQ2     RMB     1
01850 ASQ3     RMB     1
01860 ASQ4     RMB     1
01870 BSQ1     RMB     1
01880 BSQ2     RMB     1
01890 BSQ3     RMB     1
01900 BSQ4     RMB     1
01910 SUM1     RMB     1
01920 SUM2     RMB     1
01930 SUM3     RMB     1
01940 SUM4     RMB     1
01950 DIF1     RMB     1
01960 DIF2     RMB     1
01970 DIF3     RMB     1
01980 DIF4     RMB     1
01990 ACROSS   RMB     1
02000 DOWN     RMB     1
02010 SIGN     RMB     1
02020 CTABLE   RMB     256
02030          END     START
```

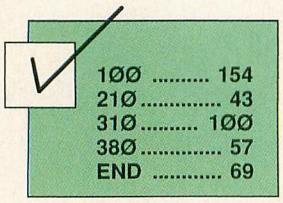
Next increase the YLOC by its step value and finish checking the column. When this is done, add the *x* step to XLOC and start all over. After all 128 columns have been checked, the display is finished.

Type in the machine language program and check for errors using A/NO/NS/WE; when it is error-free, save it with A SCALEMAN.BAS. If you want to save the source code, enter W SCALEMAN.SRC. Then type in the BASIC program and save it as SCALEMAN.BIN. When you run the BASIC program, it checks to see if the machine language program has been loaded. The first data line gives the locations for an interesting display. Try it and save the picture using:

```
SAVEM"SCALEMAN.PIX",&HE00,&H25FF,&HE00
```

You'll use this picture in my next article. If you've added the high-speed poke, be sure to remove it before saving the picture.

There it is — a new way to work an old program. It's fast, but since the *x* step and *y* step are integers, you lose a little accuracy. You can modify the program by allowing for a higher iteration count (it would take two bytes and require changing the color scheme) or increasing the initial scale factor beyond 2^{13}. In any case, feel free to add any new color scheme and change the High/Low iteration count. In a future article, I'll modify this program by saving the count for every point and re-coloring the picture using this information.



Listing 3: SCALEDRV

```
0 ' COPYRIGHT 1990 FALSOFT, INC
1 IF PEEK(&H6000)<>204 THEN LOAD
M"SCALEMAN"
10 CLEAR 200,&H6000-1:CO=&H61B5
20 'GOSUB 320:'NORMAL COLORS
30 GOSUB 380:'6 COLOR SCHEME
40 SC=8192 '2^13
50 READ XL,XR,YB,YT
60 XL=XL*SC:XR=XR*SC:YT=YT*SC:YB
=YB*SC
70 DX=XR-XL:XS=INT(DX/128+.5):IF
 XS>255 THEN XS=255
80 DY=YT-YB:YS=INT(DY/192+.5):IF
 YS>255 THEN YS=255
90 IF XS<1 THEN XS=1
100 IF YS<1 THEN YS=1
110 IF XL<0 THEN XL=(&HFFFF+XL+1
)
120 BX=INT(XL/256)
130 LX=XL-256*BX
140 POKE&H6001,BX:POKE&H6002,LX
150 IF YB<0 THEN YB=(&HFFFF+YB+1
)
160 BY=INT(YB/256)
170 LY=YB-256*BY
180 POKE&H6007,BY:POKE&H6008,LY
190 POKE&H600D,0:POKE&H600E,XS
200 POKE&H6013,0:POKE&H6014,YS
210 LC=10:HC=255:'POKE &H6080,LC
-1:POKE &H613F,HC
220 PMODE3,1:PCLS:SCREEN1,0
230 EXEC &H6000
240 GOTO 240
250 'DATA -.19,-.13,1.01,1.06
260 'DATA -.7538125,-.7381875,.1
,.1234375
270 'DATA -.2,0,.875,1.1
280 'DATA -.713,-.4082,.49216,.7
1429
290 'DATA -.5,0,-1.1,.5,1.1
300 'DATA -1.5,+.5,-1,+1
310 'DATA -.96,-.88,.236,.30
320 FOR N=0 TO 9:POKE CO+N,0:NEX
T
330 FOR N=10 TO 18 STEP 2:POKE C
O+N,255:NEXT
340 FOR N=11 TO 17 STEP 2:POKE C
O+N,170:NEXT
350 FOR N=19 TO 25:POKE CO+N,0:N
EXT
360 FOR N=26 TO 69:POKE CO+N,85:
NEXT
370 FOR N=70 TO 255:POKE CO+N,17
0:NEXT:RETURN
380 '6 COLOR SCHEME
390 FOR N=0 TO 26:POKE CO+N,0:NE
XT
400 FOR N=27 TO 34:POKE CO+N,170
:NEXT
410 FOR N=35 TO 49:POKE CO+N,85:
NEXT
420 FOR N=50 TO 78:POKE CO+N,170
:NEXT
430 FOR N=79 TO 136:POKE CO+N,85
:NEXT:RETURN
440 FOR N=137 TO 255:POKE CO+N,1
70:NEXT:RETURN
```

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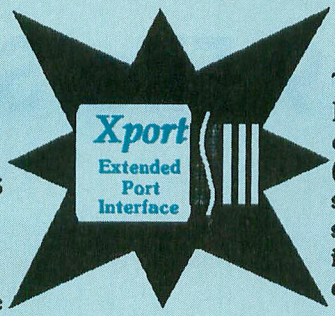

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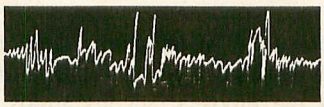

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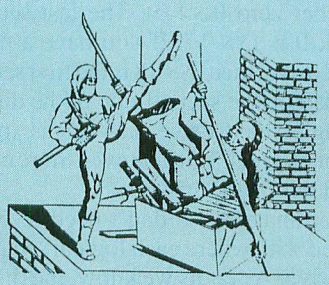

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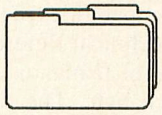

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The OS-9 File Structure

by Greg Law
Technical Editor

One of the basic building blocks of an operating system is the file structure stored on the disk. I thought it might be a good idea to take a look at the fundamental information stored in the file structure used by OS-9. There is a lot of information stored in the file structure of a disk, some of which is not accessible using regular tools such as `dir`. We'll start out this month with a basic overview of the identification sector, file descriptors and directories.

My goal is to give you the basic information with some short examples to allow you to create tools to browse through the directory tree forwards and backwards, move files from one directory to another, and even create duplicate files in one or more directories. It is possible to maintain duplicate files in multiple directories without duplicating the contents of the file itself. We'll discuss more about that later.

Unlike most disk formats, OS-9 breaks the media into *logical sector numbers* instead of tracks, sectors and heads. While this might seem a bit strange, it reduces the complexity of user-written software tremendously, since you don't have to worry about the physical specifications of the drive. For example, an average floppy drive consists of 40 tracks with 18 sectors per track. Under the logical sector format the first sector on Track 0 is Logical Sector Number zero (LSN 0). The last sector on Track 0 is LSN 17. If you have a double-sided drive, then LSN 18 is the first sector on Track 0 on the second side of the disk. For a single-sided drive, LSN 18 is the first sector of Track 1. It gets even more complicated with hard drives.

Fortunately, we don't need to be concerned with where each logical sector is on the drive. As far as we know, the drive is a flat device, much like a ruler, that is organized into 256-byte blocks. Any block can be read or written by telling OS-9 which block to use. It is the responsibility of the device driver to convert the logical sector numbers into physical parameters.

Identification Sector

Our first stop is at LSN 0, which contains the physical capabilities of the media. Page 5-2 of the Technical Reference section of the OS-9 Level II manual gives a breakdown of each byte. The first three bytes contain the total number of sectors on the disk. Remember that we start the numbering at 0 so the last sector on the disk will be one less than the number stored in this entry. The next byte defines the number of sectors per track. The following two bytes contain the number of bytes in the allocation bit map. Generally, this will be the total number of sectors divided by eight. The next two bytes define the number of sectors per cluster, which is almost always one, except as noted below.

OS-9 can access drives as large as 4096 megabytes using a three-byte logical sector number (16,777,215 logical sectors multiplied by 256 bytes per sector). However, Microware added the capability to use even larger drives by allowing you to group two or more physical sectors into a single logical sector (often referred to as a cluster). If you formatted the drive with two sectors per cluster, then Cluster 0 would be physical sectors zero and one. If you used three sectors per cluster then Cluster 0 would be physical sectors zero, one and two. But, unless you are real lucky to own a super-large drive, then you don't even need to worry about this. Just be happy that Microware had the foresight to include the capability to access large media such as compact disks. Considering that OS-9 was developed in the mid-to-late '70s, this was really thought out. I mean, who would have imagined owning a four-gigabyte drive back then?

The next two bytes contain the logical sector number of the root directory. Following this is the owner (the user ID of the person that formatted the disk) and the attributes of the disk. The disk attributes are the same as for a file with a little twist. If the disk attributes don't have write per-

In addition to being OS-9 Online SIGop, Greg Law enjoys programming on all types of computers and has worked on systems ranging from the CoCo to the Burroughs B6700 super mainframe. He lives in Louisville, Kentucky.

Listing 1: `files.b09`

```
PROCEDURE files
0000       BASE 0
0002
0003       TYPE Dir_Type=Name:STRING[29]; LSN(3):BYTE
001E       TYPE Map_Type=Segment(3):BYTE; Sectors:INTEGER
0034       TYPE File_Type=Attribute:BYTE; Owner_ID:INTEGER; Mod_Date(5
            ):BYTE; Link:BYTE; FileSize(2):INTEGER; Create_Date(3
            ):BYTE; Alloc(48):Map_Type
0079
007A       DIM Dir_Entry:Dir_Type
0083       DIM File_Des:File_Type
008C       DIM Dir_PN,Drive_PN:INTEGER
0097       DIM Filename:STRING[30]
00A3       DIM Offset:REAL
00AA       DIM Count:INTEGER
00B1
00B2       OPEN #Dir_PN,".":READ+DIR
00BE       OPEN #Drive_PN,"@":READ
00CA
00CB       PRINT "Filename        LSN Sectors LSN Sectors ";
00F8       PRINT "LSN Sectors LSN Sectors LSN Sectors"
011F       PRINT "--------------- ------ ---- ------ ---- ";
```


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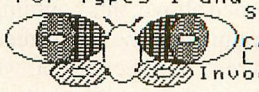

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mission enabled, then you can't write to any part of the disk. It's almost the same as putting a write-protect sticker on the disk.

File Descriptors

To progress through the directory tree you would normally begin at the identification sector with the `DD.DIR` entry at Offset $08. As mentioned above, this contains the logical sector number of the root directory. If you were to read this sector, you would find the file descriptor for the root directory. Every file and directory on the disk has a file descriptor that contains the description for the file.

It is possible to maintain duplicate files in multiple directories without duplicating the contents of the file itself.

The entries defined in the file descriptor include the attributes, user ID of the owner, last modified date, link count, file size, creation date and a segment list. In the listing these are shown as the `file_des` structure. The owner is usually the person that created the file. The link count is a very bizarre and rarely-used entry. As a matter of fact, none of the tools supplied with OS-9 allow you to manipulate or view the link count directly. We will examine it later.

The segment list consists of 48 five-byte entries. The first three bytes of each entry contain the logical sector number for the file and the last two bytes contain the number of sectors occupied by the file. For example, let's assume the segment list contains the values $000010, $0015, $000040, $0012, $000000 and $0000. In this ex-

```
014C       PRINT "------ ---- ------ ---- ------ ----"
0173
0174       WHILE NOT(EOF(#Dir_PN)) DO
017F         GET #Dir_PN,Dir_Entry
0189         RUN strhcpy(Filename,Dir_Entry.Name)
019B
019C         IF Filename<>"" THEN
01A8           RUN l3tol(Offset,Dir_Entry.LSN(0),Dir_Entry.LSN(1),Dir_Entry.LSN
                (2))
01D0           SEEK #Drive_PN,Offset
01DA           GET #Drive_PN,File_Des
01E4           PRINT USING "S16",Filename;
01F1
01F2           FOR Count:=0 TO 47
0202             RUN l3tol(Offset,File_Des.Alloc(Count).Segment(0),File_Des.Alloc
                  (Count).Segment(1),File_Des.Alloc(Count).Segment
                  (2))
023C
023D               IF MOD(Count,5)=0 AND Count<>0 THEN
0253                 PRINT
0255                 PRINT TAB(17);
025B               ELSE IF Offset=0 THEN
026B                    PRINT
026D                    GOTO 10
0271                 ENDIF
0273               ENDIF
0275
0276               PRINT USING "H2,H2,H2,S1,H4,S1",File_Des.Alloc(Count)
                    .Segment(0),File_Des.Alloc(Count).Segment(1),File_Des.Alloc
                    (Count).Segment(2)," ",File_Des.Alloc(Count).Sectors
                    ," ";
02CF             NEXT Count
02DA           ENDIF
02DC 10    ENDWHILE
02E3
02E4       CLOSE #Drive_PN
02EA       CLOSE #Dir_PN
02F0       END

PROCEDURE strhcpy
0000       PARAM Filename,Name:STRING
000B       DIM Count:INTEGER
0012       DIM i:INTEGER
0019
001A       Filename:=""
0021       FOR Count:=1 TO 29
0031         i:=ASC(MID$(Name,Count,1))
0040         IF i=0 THEN
004C           GOTO 10
0050         ENDIF
0052         IF i>127 THEN
005E           i:=LAND(i,127)
0069           Filename:=Filename+CHR$(i)
0076           GOTO 10
007A         ELSE
007E           Filename:=Filename+CHR$(i)
008B         ENDIF
008D       NEXT Count
0098 10    (* Return to the caller *)
00B5       END

PROCEDURE l3tol
0000       PARAM Offset:REAL
0007       PARAM b1,b2,b3:BYTE
0016       DIM i1,i2,i3:REAL
0025
0026       Offset:=ABS(b1*256*256)
0038       Offset:=ABS(Offset+b2*256)
004A       Offset:=ABS(Offset+b3)
0058       Offset:=ABS(Offset*256)
0066       END
```

Listing 2: `files.c`

```
#include <stdio.h>
#include <ctype.h>

#define _DIR   0x80
#define _READ  0x01
```

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ample, the contents of the file begins at LSN $10 and occupies $15 sectors. It then jumps to LSN $40 and occupies $12 additional sectors. The sectors between LSN $25 and LSN $3F are either unused or occupied by another file. The end of the chain is signified by a null entry (an entry containing all zeros) as shown above. However, if all 48 entries are used, there will not be a null entry.

Directories

Each entry in the directory consists of a 29-byte filename followed by the logical sector number for the file descriptor. As mentioned above, the logical sector number is three bytes. However, there are two special files stored in each directory. The first entry is always dot-dot (..) and contains the logical sector number for the file descriptor of its parent directory. The second entry is always dot (.) and contains the logical sector number for its own file descriptor. These two entries are very important and play a crucial role in traversing the directory trees. We will cover these two directory entries in-depth next month.

For this month, browse through the first five pages of Chapter 5, "Random Block File Manager," in the Technical Reference section of the OS-9 Level II manual. You don't need to be overly concerned with any of the details. For the most part just familiarize yourself with the information given. It is also helpful to have an understanding of the basics of directories given in Chapter 4, "Files and Directories," of the Getting Started section.

To assist you in familiarizing yourself with the segment allocation table in the file descriptors, I've included two short listings. One of them is in BASIC09 and the other is in C. Both function identically, so use whichever you feel most comfortable with. When you run the program it will print a listing of all files in the current directory followed by the entries in the segment allocation table for that file. You may want to modify the programs to print the other information contained in the file descriptor as well.

This should be enough information to familiarize you with the file structure used by OS-9. I don't want to present too much information; you may end up totally confused. For that reason I'll keep it in digestable chunks. Play around with the listings and have some fun with the basics this month. Next month we will take a deeper look at the file structure, discuss some of the methods used to traverse the directory trees, and give some insight into how the pwd and pxd commands work.

❑

```
struct {
     char      name[29];
     char      lsn[3];
} dir_entry;

struct map {
     char      segment[3];
     unsigned  sectors;
};

struct {
     char      attribute;
     unsigned  owner_id;
     char      mod_date[5];
     char      link;
     long      filesize;
     char      creat_date[3];
     struct map alloc[48];
} file_des;

main()
{
     int       dir_pn, drive_pn;
     char      filename[30];
     long      offset;

     pflinit();          /* initialize long integer routines */

     if((dir_pn = open(".", _DIR+_READ)) == EOF)
          exit(errno);

     if((drive_pn = open("@", _READ)) == EOF)
          exit(errno);

     printf("Filename        LSN Sectors LSN Sectors ");
     printf("LSN Sectors LSN Sectors LSN Sectors\n");
     printf("--------------- ------ ---- ------ ---- ");
     printf("------ ---- ------ ---- ------ ----\n");

     while((read(dir_pn, &dir_entry, sizeof(dir_entry))) != 0) {
          strhcpy(filename, dir_entry.name);

          if(filename[0] != '\0') {
               l3tol(&offset, dir_entry.lsn, 1);
               offset *= 256L;
               lseek(drive_pn, offset, 0);
               read(drive_pn, &file_des, sizeof(file_des));
               show(filename);
          }
     }
}

show(filename)
char *filename;
{
     long offset;
     int  count;

     printf("%-15s", filename);

     for(count = 0; count < 48; count++) {
          l3tol(&offset, file_des.alloc[count].segment, 1);

          if(((count % 5) == 0) && (count != 0))
               printf("\n               ");

          else if(offset == 0) {
               printf("\n");
               return;
          }

          printf(" %06lX %04X", offset, file_des.alloc[count].sectors);
     }
}
```

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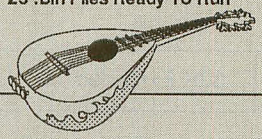

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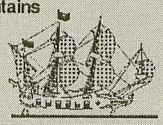

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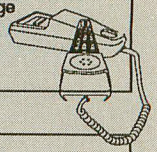

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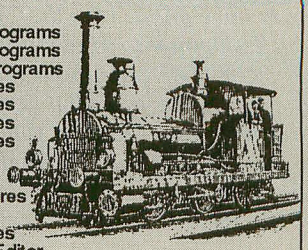

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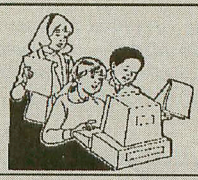

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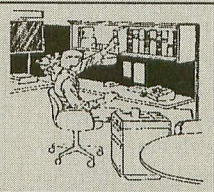

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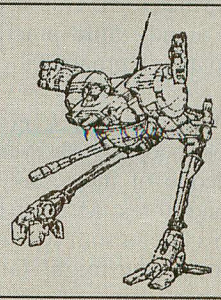

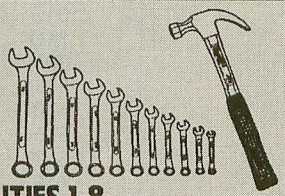

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A Real Clef Hanger

by Fred B. Scerbo
Contributing Editor

If you have an idea for the "Wishing Well," submit it to Fred c/o THE RAINBOW. *Remember, keep your ideas specific, and don't forget this is* BASIC. *All programs resulting from your wishes are for your use, but remain the property of the author.*

Last month we took a stroll to the college of musical knowledge with *Music 102*, reading the G clef. This next installment includes handy little practice sessions on how to merge programs.

And Now, the Bass Clef

Most people with even a very limited knowledge of music are familiar with a staff and notes. Most of them have been shown a G-clef staff with a melody line on it such as you might find in a book of Christmas songs.

This month I discuss the F or Bass clef, which corresponds to the left hand on the piano. Other instruments such as the trombone, bass guitar and accordion also use the F clef.

When I was six years old, my parents had me take accordion lessons. At the time it looked as if there might be a big demand for performances of "Lady Of Spain." Happily, those times have passed.

You see, the left hand on an accordion is read with an F clef but played very differently from the left hand on the piano. In either case an F-clef note is read one full line or space below the same note on the G clef. If you have a "mono" mind as I do, reading both clefs simultaneously can be a real task.

Music 103 was written to complement *Music 102* and works the same way as the first two programs. Section A lets you review all the notes and their identifications. Sections B and C quiz you on the material. You must use the space bar to select your answer and press ENTER when you have the right choice. Pressing @ lets you check your score; pressing C from the score card lets you continue. If you read last month's article, you already know this. So let's move right along to the creation of *Music 104* using the MERGE command. This month's lesson is a good hands-on lesson in how to merge programs, which is a valuable skill even if you are not interested in the musical aspects of the program.

How MERGE Works

The MERGE command is a very handy little tool that lets you put parts of two different programs together. There are two catches, however. First you need Disk Extended BASIC. Secondly the program lines may not overlap. (This is solved by using RENUM, which has already been done for you.)

Here are the steps you must take to create *Music 104*:

- Save Listing 1 using SAVE"MUSIC103",A. The ,A saves the program in ASCII values rather than in tokenized form. This allows you to merge later.

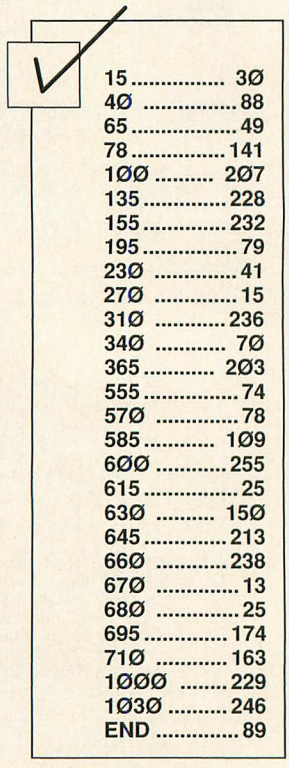
- Load in *Music 102* from last month. This need not have been saved in ASCII.

- Delete the following lines using the

Fred Scerbo is a special needs instructor for the North Adams Public Schools in North Adams, Massachusetts. He holds a master's in education and has published some of the first software available for the Color Computer through his software firm, Illustrated Memory Banks.

32K Extended

Editor's Note: The completed program for Music 104 is provided on this month's RAINBOW ON TAPE/DISK for your convenience.



Listing 1: MUSIC103

```
1 REM****************************
2 REM* MUSIC 103:READING F CLEF*
3 REM*   COPYRIGHT (C) 1990    *
4 REM*    BY FRED B. SCERBO    *
5 REM*    60 HARDING AVENUE    *
6 REM*  NORTH ADAMS, MA 01247  *
7 REM****************************
8 CLEAR8000:XX=RND(-TIMER):NN=17
9 CLS0:PRINTSTRING$(32,220);STRI
```

```
NG$(32,204);:FORI=1TO224:READA:P
RINTCHR$(A+128);:NEXT
10 PRINTSTRING$(32,195);STRING$(
32,211);
15 PRINT@390,"   READING F CLEF
 ";
20 PRINT@422,"  BY FRED B.SCERBO
  ";:PRINT@454," COPYRIGHT (C) 1
990 ";
25 DATA61,60,60,62,60,61,48,61,,
,,62,48,62,60,60,60,61,48,61,56,
53,60,60,60,61,48,,,,,
30 DATA53,,,58,,53,,53,,,,58,48,
58,,,,,,53,,53,,,,,,,,,
35 DATA53,,,58,,53,,53,,,,58,48,
58,,,,,,53,,53,,,71,,78,76,77,68
,76,77
40 DATA53,,,58,,53,,53,,,,58,,60
,60,60,60,61,,53,,53,,,69,,74,,6
9,68,76,77
45 DATA53,,,58,,53,,53,,,,58,,,,
,,53,,53,,53,,,76,72,76,76,76,68
,76,76
50 DATA53,,,,,53,,53,,,,58,,50,,
,,53,,53,,53,,,,49,,,,,,
55 DATA60,56,,,,60,56,52,60,60,6
0,56,,60,60,60,60,60,,60,56,52,6
0,60,60,60,,,,,,
60 X$=INKEY$:IFX$<>CHR$(13)THEN6
0
65 NN=NN+1:DIM P$(NN,3),A$(6),B$
(NN),C$(NN),A(NN),N(NN),B(4),C(4
),D(4),E(4),F(4),AO(NN):NN=NN-1
71 BC$="BU6BR14BD14NR98BD10NR98B
D10NR98BD10NR98BD10NR98R14BL6BU6
E18U6H6L6G6D6BR22U2BU8U2BL10BD32
":BA$="BD48BL30R10D6L8U6D12L2R10
NU8BR8U12R8D6NL8D6BR8R8U6L8U6R8B
R8NR8D6R8D6L8"
76 FORI=1TO3:READ C(I),D(I),E(I)
,F(I):NEXT:FORI=1TO6:READA$(I):N
EXT
78 FORI=NM+1TO NN:READP$(I,1),P$
(I,2):P$(I,1)=BC$+P$(I,1):P$(I,2
)="BU10"+P$(I,2)+BA$:NEXT
80 COLOR1,0
85 CLS:PRINT:PRINTSTRING$(32,"=")
;:PRINT@102,"AN INTRODUCTION TO
":PRINT@137,"F CLEF NOTES":PRINT
@199,"A) REVIEW NOTES":PRINT@263
,"B) QUIZ NOTES":PRINT@327,"C) R
EVERSE NOTES"
90 PRINT@388,"<<<SELECT YOUR CHO
ICE>>>"
95 PRINT:PRINTSTRING$(32,"=");
100 X$=INKEY$:X=RND(-TIMER):IFX$
="A"THEN355ELSEIFX$="B"THEN105EL
SEIFX$="C"THEN1000ELSE100
105 CLS0:PMODE0,1:PCLS1
110 LINE(0,0)-(254,170),PRESET,B
115 LINE(6,4)-(122,82),PRESET,BF
120 LINE(128,4)-(248,82),PRESET,
B
125 LINE(6,86)-(122,164),PRESET,
B
130 LINE(128,86)-(248,164),PRESE
T,B
135 DRAW"BM26,188C0NU10R10NU10BR
6R10U6L10U4R10BR6NR10D4NR10D6R10
BR12BU6NE4D2F4BR6R10U6L10U4R10BR
6ND10R10D4NL10BR6NR10D6U10R10D10
BR6NR10U10R10BR6NR10D4NR10D6R10B
R10U10NL4R10D4NL10D6NL14BR6U10R1
0D4NL10D6BR6U10R10D4L10R4F6BR6E4
U2H4"
140 DATA130,6,246,80,6,86,120,16
2,130,86,246,162
145 PAINT(2,2),0,0:PCOPY1TO3
```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DEL command (press ENTER after each):

```
DEL -65
DEL 80-380
DEL 1000-
```

• Using the disk on which you have saved *Music 103*, enter MERGE"MUSIC103". The disk spins and merges the two programs together. I made sure the data lines do not overlap.

• Type in the short listing called FIXER. It is made up of lines 2, 8, 15, 35, 45, 61, 65, 77 and 85. If you have RAINBOW ON DISK, load FIXER and resave it in ASCII format. Then merge it into memory as explained above.

This month's lesson is a good hands-on lesson in how to merge programs.

• Next delete Line 76 with DEL 76.

• Finally save the completed program to disk with SAVE"MUSIC104".

You now have an error-free version of *Music 104* that will not have its own listing or article. It works exactly like versions 101 through 103; however, the program will be a little slower in setting up the quiz screen since so much string space must be reserved (in Line 8). Therefore, when you press B or C, expect to wait a minute or two for it to do its string work. The screen is black while this is happening. ❑

```
150 PMODE0,4:PCLS1
155 LINE(0,0)-(254,170),PRESET,B
F
160 LINE(8,6)-(120,80),PSET,BF
165 PCOPY4TO2:PMODE0,1:SCREEN1,1
170 DATA"BM2,8C1","BM130,8C0","B
M2,90C0","BM130,90C0","BM2,48C0"
,"BM130,48C0"
175 FORI=1TO NN
180 A(I)=RND(NN):IFN(A(I))=1THEN
180
185 N(A(I))=1:NEXTI:FORY=1TO NN:
COLOR1,0
190 FORI=2TO4
195 B(I)=RND(3)+1:IFN(B(I))=0THE
N195
200 N(B(I))=0:NEXTI:FORI=1TO4:N(
I)=1:NEXT
205 B=RND(NN):IFB=A((Y))THEN205
210 C=RND(NN):IFC=B OR C=A((Y))T
HEN210
215 DRAW A$(1):DRAWP$(A(Y),1)
220 DRAW A$(B(2)):DRAWP$(B,2):DR
AWP$(B,3)
225 DRAW A$(B(3)):DRAWP$(C,2):DR
AWP$(C,3)
230 DRAW A$(B(4)):DRAWP$(A(Y),2)
:DRAWP$(A(Y),3)
235 COLOR1,0
240 Z=0
245 PMODE0,4
250 DRAW A$(1)+"C0":DRAWP$(A(Y),
1)
255 DRAW A$(B(2))+"C1":DRAWP$(B,
2):DRAWP$(B,3)
260 DRAW A$(B(3))+"C1":DRAWP$(C,
2):DRAWP$(C,3)
265 DRAW A$(B(4))+"C1":DRAWP$(A(
Y),2):DRAWP$(A(Y),3)
270 PMODE0,1:SCREEN1,1
275 LINE(8,6)-(120,80),PSET,B
280 X$=INKEY$:IFX$=" "THEN290ELS
EIFX$="@"THEN1010
285 COLOR1,0:LINE(8,6)-(120,80),
PRESET,B:GOTO275
290 Z=Z+1:IFZ=4THENZ=1
295 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PSET,B
300 X$=INKEY$:IFX$=" "THEN290ELS
EIFX$=CHR$(13)THEN310ELSEIFX$="@
"THEN1010
305 COLOR1,0:LINE(C(Z),D(Z))-(E(
Z),F(Z)),PRESET,B:GOTO295
310 IFZ+1=B(4)THEN320
315 NW=NW+1:FORK=1TO5:PMODE0,4:S
CREEN1,1:SOUND10,3:PMODE0,1:SCRE
EN1,1:SOUND1,3:NEXTK:GOTO295
320 NC=NC+1:PMODE0,4:PCLS1:LINE(
0,40)-(256,126),PRESET,B:LINE(6,
44)-(124,122),PRESET,B:LINE(130,
44)-(248,122),PRESET,B:PAINT(2,4
2),0,0
325 DRAW A$(5):DRAWP$(A(Y),1)
330 DRAW A$(6):DRAWP$(A(Y),2):DR
AWP$(A(Y),3)
335 SCREEN1,1
340 X$=INKEY$:IFX$<>CHR$(13)THEN
340
345 PMODE0,1
350 PCOPY3TO1:SCREEN1,1:PCOPY2TO
4:NEXTY:GOTO1010
355 PMODE0,2:PCLS1:SCREEN1,1:LIN
E(0,40)-(256,126),PRESET,B:LINE(
6,44)-(124,122),PRESET,B:LINE(13
0,44)-(248,122),PRESET,B:PAINT(2
,42),0,0
360 FORI=1TO NN:DRAW A$(5):DRAWP
$(I,1)
365 DRAW A$(6):DRAWP$(I,2):DRAWP
$(I,3)
370 X$=INKEY$:IFX$<>CHR$(13)THEN
370
375 COLOR1,0:LINE(8,46)-(122,120
),PSET,BF:LINE(132,46)-(246,120)
,PSET,BF:NEXTI
380 RUN
555 DATA"BR64BD22NU36R4L24R2E6R6
F4BU8NR6NL18BD8D4G4L6H4BL22BU2U3
4E4R6F4D2G4L6H4U2"
560 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48L8U12R8"
565 DATA"BR64BD22NU36R4L24R2E6R6
F4BU8NR6NL18BD8D4G4L6H4BL22BU2U3
4E4R6F4D2G4L6H4U2BH6BL2D14BL4U14
D4L4R12L4D6R4L12BD24BR30D14BL4U1
4D4L4R12L4D6R4L12"
570 DATA"BR26BD50R8U6L8U6R8BR6D1
2U6R8U6D12BR6U12R8D6NL8D6BR6U12R
8D6L8R2F6BR6U12R8D6L8BU18BL22L8U
12R8"
575 DATA"BR64BD18NU36ND2BL14E4R6
U2NL14NR8D2F4D4G4L6H4U2BL22BU2U3
6E4R6F4D4G4L6H4U2BH6BL4D14E4U2H4
BD30BR24D14E4U2H2"
580 DATA"BR36BD50U6NR8U6R8BR6D12
R8BR7U12R8D6NL8D6BR10U12L4R8BL32
BU12R8NU12L10R2U12L2R10"
585 DATA"BR64BD18NU36ND2BL14E4R6
```

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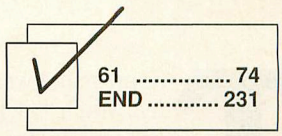
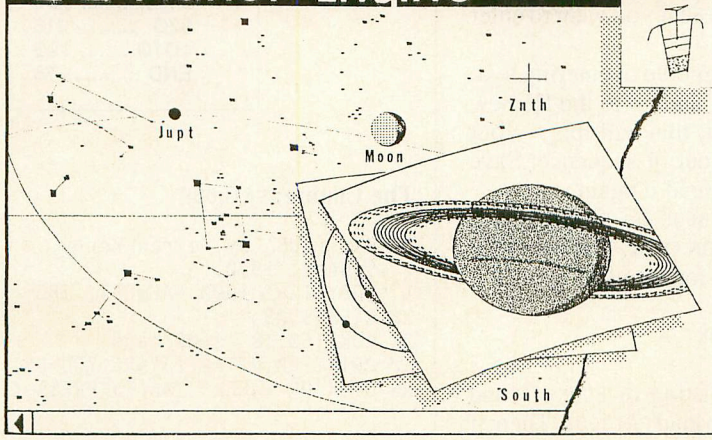
```
U2NL14NR8D2F4D4G4L6H4U2BL22BU2U3
6E4R6F4D4G4L6H4U2"
590 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48NU12L10R2U12L2R
10"
595 DATA"BR64BD18NU36ND2BL14E4R6
U2NL14NR8D2F4D4G4L6H4U2BL22BU2U3
6E4R6F4D4G4L6H4U2BH6BL2D14BL4U14
D4L4R12L4D6R4L12BD24BR30D14BL4U1
4D4L4R12L4D6R4L12"
600 DATA"BR26BD50R8U6L8U6R8BR6D1
2U6R8U6D12BR6U12R8D6NL8D6BR6U12R
8D6L8R2F6BR6U12R8D6L8BU18BL30R8N
U12L10R2U12L2R10"
605 DATA"BR64BD14NU36R4L24R2E6R6
F4D4G4L6H4BL22BU4U34E4R6F4D2G4L6
H4U2BH6BL4D14E4U2H4BD30BR24D14E4
U2H2"
610 DATA"BR36BD50U6NR8U6R8BR6D12
R8BR7U12R8D6NL8D6BR10U12L4R8BL26
BU12L8U6NR8U6R8"
615 DATA"BR64BD14NU36R4L24R2E6R6
F4D4G4L6H4BL22BU4U34E4R6F4D2G4L6
H4U2"
620 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48L8U6NR8U6R8"
625 DATA"BR64BD8NU36ND2BL14E4R6F
4D2G4L6H4BL22BU2U36E4R6F4D4G4L6H
4U2"
630 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL56U6NR8U6R8"
635 DATA"BR64BD8NU36ND2BL14E4R6F
4D2G4L6H4BL22BU2U36E4R6F4D4G4L6H
4U2BH6BL2D14BL4U14D4L4R12L4D6R4L
12BD24BR30D14BL4U14D4L4R12L4D6R4
L12"
640 DATA"BR26BD50R8U6L8U6R8BR6D1
2U6R8U6D12BR6U12R8D6NL8D6BR6U12R
8D6L8R2F6BR6U12R8D6L8BU18BL30U6N
R8U6R8"
645 DATA"BR64BD4NU36R4L24R2E6R6F
4D4G4L6H4BL22BU4U34E4R6F4D2G4L6H
4U2BH6BL4D14E4U2H4BD30BR24D14E4U
2H2"
650 DATA"BR36BD50U6NR8U6R8BR6D12
R8BR7U12R8D6NL8D6BR10U12L4R8BL26
BU12NU6L8U12R8BD6L2BU8BR2"
655 DATA"BR64BD4NU36R4L24R2E6R6F
4D4G4L6H4BL22BU4U34E4R6F4D2G4L6H
4U2"
660 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48NU6L8U12R8BD6L2
BU8BR2"
665 DATA"BR64BD4NU36R4L24R2E6R6F
4D4G4L6H4BL22BU4U34E4R6F4D2G4L6H
4U2BH6BL2D14BL4U14D4L4R12L4D6R4L
12BD24BR30D14BL4U14D4L4R12L4D6R4
L12"
670 DATA"BR26BD50R8U6L8U6R8BR6D1
2U6R8U6D12BR6U12R8D6NL8D6BR6U12R
8D6L8R2F6BR6U12R8D6L8BU18BL22NU6
L8U12R8BD6L2BU8BR2"
675 DATA"BR64BU2NU36ND2BL14E4R6F
4D2G4L6H4BL22BU2U36E4R6F4D4G4L6H
4BH6BL4D14E4U2H4BD30BR24D14E4U2H
2"
680 DATA"BR36BD50U6NR8U6R8BR6D12
R8BR7U12R8D6NL8D6BR10U12L4R8BL26
BU12U12L8D6NR8D6BU12BR8"
685 DATA"BR64BU2NU36ND2BL14E4R6F
4D2G4L6H4BL22BU2U36E4R6F4D4G4L6H
4U2"
690 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48U12L8D6NR8D6BU1
2BR10"
695 DATA"BR64BU2NU36ND2BL14E4R6F
4D2G4L6H4BL22BU2U36E4R6F4D4G4L6H
4U2BH6BL2D14BL4U14D4L4R12L4D6R4L
12BD24BR30D14BL4U14D4L4R12L4D6R4
L12"
700 DATA"BR26BD50R8U6L8U6R8BR6D1
2U6R8U6D12BR6U12R8D6NL8D6BR6U12R
8D6L8R2F6BR6U12R8D6L8BU18BL22U12
L8D6NR8D6BU12BR10"
705 DATA"BR64BU6NU36R4L24R2E6R6F
4D4G4L6H4BL22BU4U34E4R6F4D2G4L6H
4U2BH6BL4D14E4U2H4BD30BR24D14E4U
2H2"
710 DATA"BR36BD50U6NR8U6R8BR6D12
R8BR7U12R8D6NL8D6BR10U12L4R8BL26
BU12L10R2U6NR8U6L2R10ND12"
715 DATA"BR64BU6NU36R4L24R2E6R6F
4D4G4L6H4BL22BU4U34E4R6F4D2G4L6H
4U2"
720 DATA"BR12BD50U12F12NU12BR6U1
2R8D6NL8D6BR10U12L4R8BR6D12R8NU1
2BR6U12R8D6L8R2F6BR6U12R8D6NL7D6
BR6NU12R8BU24BL48NU12L10R2U6NR8U
6L2R10"
1000 CLS0:FORI=1TO NN:TEM$=P$(I,
1):P$(I,1)=P$(I,2):P$(I,2)=TEM$:
NEXT
1005 GOTO105
1010 CLS:PRINT@101,"YOU TRIED"NC
+NW"TIMES &":PRINT@165,"ANSWERED
"NC"CORRECTLY"
1015 PRINT@229,"WHILE DOING"NW"W
RONG."
1020 NQ=NC+NW:IF NQ=0THEN NQ=1
1025 MS=INT(NC/NQ*100)
1030 PRINT@293,"YOUR SCORE IS"MS
"%."
1035 PRINT@357,"ANOTHER TRY (Y/N
/C) ?";
1040 X$=INKEY$:IFX$="Y"THEN RUN
1045 IFX$="N"THENCLS:END
1050 IFX$="C" AND Y<=17 THEN270
1055 GOTO1040
```

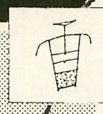


Listing 2: FIXER

```
2 REM* MUSIC 104: G AND F CLEF *
8 CLEAR9650:XX=RND(-TIMER):NN=17
15 PRINT@390," READING G & F CLE
F ";
35 DATA53,,,58,,53,,53,,,,58,48,
58,,,,,,53,,53,,,71,,,78,76,77,69
,,69
45 DATA53,,,58,,53,,53,,,,58,,,,
,,53,,53,,53,,,76,72,76,76,76,,,
68
61 NN=34:NM=17
65 NN=NN+1:DIM P$(NN,3),A$(6),B$
(NN),C$(NN),A(NN),N(NN),B(4),C(4
),D(4),E(4),F(4),AO(NN):NN=17
77 NN=34
85 CLS:PRINT:PRINTSTRING$(32,"=")
;:PRINT@102,"AN INTRODUCTION TO
":PRINT@137,"G AND F CLEF":PRINT
@199,"A) REVIEW NOTES":PRINT@263
,"B) QUIZ NOTES":PRINT@327,"C) R
EVERSE NOTES"
```


Planet Engine





GRAVITY STUDIO

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Belton, TX 76513-791
Add $2 S/H. Add $5 S/H if outside US. Add 7.5% tax if in Texas

$15 Intro Price !

Planet Engine is a program that takes your time and location to chart a colored sky of planets, stars, and the Moon and Sun. Upon startup, the planets are mapped from current computer time and boldly drawn on the field of equatorial stars beyond. From here you can request orbits, precise data, planet drawings; or skip around to any past or future time or location. The Moon and all planets are shadowed to their proper phase; Earth is shadowed for its appearance from the Moon.

Those with Multi-Vue can execute Planet Engine from mouse clicks and icons; the pull-down menus, scroll buttons, and overlay windows make your experience stimulating and delightful. Your Earth location and display group list is conveniently stored in the AIF file and passed to Planet Engine every time you 'doubleclick' on the 'Planet' icon. Also with Multi-Vue, you can scroll the sky east or west to check the approximate rise or set times of any displayed object with the horizon line.

Teachers and star-gazers will love the display groups that can be switched on or off: Planets, Stars, Moon/Sun, and Annotation (labels). This feature lets you watch just the Sun and Moon in the sky; or turn everything off except the stars and move the stars through their seasonal appearances. Teachers, make your students leave off the labels to identify planets by appearance only. Travelers and eclipse-chasers can reset the Planet Engine to another part of the world and pre-observe what astronomical opportunities await them. Your personal planetarium is ready !

* THE PLANET ENGINE IS $24, BUT ONLY $15 IF ORDER POSTMARKED BEFORE JUNE 1, 1990 !
* Requirements: Coco 3 + OS-9 Level 2 + 128K Minimum
* Both Multi-Vue and non-Multi-Vue versions are included at one price !
* Also included for Multi-Vue users: AIF files, and "Planet" icon.
* Multi-Vue is required for the high-level mouse and menu version.

New routines for a growing program

Booklet, Revisited

by Keiran Kenny

The program I wrote called *Booklet*, which THE RAINBOW published in January 1989, attracted quite a bit of reader response. As a result of reader suggestions, the program has grown considerably. I first added Save/Load routines for complete texts, then a Text-Review routine, and finally Save/Load routines for partially completed text. The new version can be used for tape or disk operation.

To add these enhancements to the original BOOKLET listing, enter the lines in PATBOOK carefully, copying the line numbers exactly as they are written. You may also delete lines 80 through 100 in the original if you like.

These changes apply to the six-page version of *Booklet* as published, but there is also a 14-page version, a version for condensed font and versions to enable the use of the most commonly used accents in French- and Dutch-language texts.

Typing 162 lines of text nonstop in the six-page version was quite a chore; typing 378 lines for a 14-pager was an endurance test. But now when it's bedtime, you can finish the line you are on. At the beginning of the next line press SHIFT-right arrow (a right bracket will be displayed on the screen), and press ENTER.

This brings the program to Line 802 to save the text. All tape files are saved as PARTFILE so note the counter number at which the save begins. Disk users must enter a unique filename. The next morning you can run BOOKLET and take Option 1 at the prompt (Line 71) to load the text. You are asked "Is this file complete? Y/N". To load your partly completed file, press N. Follow the tape or disk prompts and your file will be loaded. The last five lines are displayed on the screen to remind you where you stopped. Press any key and you can continue typing from where you left off. Thereafter you can stop, save and load again whenever you feel like it.

To load a complete file, press Y at the "Is this file complete?" prompt. This transfers control to Line 900. You are then returned to the prompt in Line 350 to print the text. The routine at Line 1000 saves the completed files.

To review the text, load a file, press BREAK, then enter GOTO1100. Browse through your text and note the line numbers of any strings that need correction. Make your corrections and enter GOTO350 if you want to print the text or GOTO1000 if you want to save it again and print it later. If your file is incomplete, type GOTO802 and save it or CLS:GOTO150 if you want to enter more lines.

If you are in the middle of entering text, do not press BREAK and go to the Review routine or correct it; this will throw your line or page count out of sequence. Save your file first, then load it again.

If you have PATBOOK on RAINBOW ON TAPE or RAINBOW ON DISK, load PATBOOK and save it in ASCII format using:

```
(C)SAVE"PATBOOK",A
```

Load the original listing of BOOKLET and position your tape to load PATBOOK. Then, if you are using a cassette, type:

```
OPEN"I",-1,"":POKE111,255: EXEC44156
```

and press ENTER. If you are using a disk, enter:

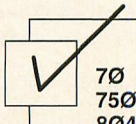
```
MERGE"PATBOOK/BAS"
```

Your PATBOOK listing is merged with the BOOKLET listing. You can save the entire listing as BKLTPLUS. ❑

Keiran Kenny began programming after seven years of retirement. He is interested mainly in CoCo's graphic and math possibilities but likes to try everything. He may be contacted at 2/45 Cremorne Road, Cremorne NSW Australia 2090.

16K Extended

Editor's Note: The complete, patched BLKTPLUS *program appears on this month's* RAINBOW ON TAPE/DISK.

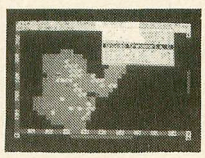


```
7Ø ..... 43
75Ø ..... 132
8Ø4 ..... 78
828 ..... 99
844 ..... 1Ø6
92Ø ..... 218
1Ø1Ø ..... 12Ø
END ..... 76
```

The Listing: PATBOOK

```
Ø 'BKLTPLUS' by Keiran Kenny,
   Sydney, 1990.
1 'COPYRIGHT 1990 FALSOFT, INC
22 CLEAR5508
24 POKE150,18 '2400 baud
60 PRINT:PRINTTAB(2)"ARE YOU USI
NG DISK OR TAPE?",TAB(7)"PRESS <
```

```
D> OR <T>."
62 K$=INKEY$:IFK$=""THEN62
64 IFK$="D"THENDV=1:GOTO70
66 IFK$="T"THENDV=-1:GOTO70
68 GOTO62
70 CLS:DIMA$(162)
71 PRINT@160,"YOU CAN":PRINT:PRI
NTTAB(3)"1. LOAD A SAVED FILE",T
AB(3)"2. TYPE A NEW TEXT.",TAB(8
)"PRESS 1 OR 2."
72 K$=INKEY$:IFK$=""THEN72
73 IFK$="1"THEN820
74 IFK$="2"THENCLS:GOTO110
75 GOTO72
140 CLS:PN=1:B=1
160 POKE282,0:FORT=B TOLP*6
195 IFA$(T)="]"THENB=T:T=T-1:LN=
LN-1:GOTO802
750 IFK$="N"ORK$="n"THEN761
761 CLS:PRINT@224,"SAVE YOUR TEX
T? Y/N"
762 K$=INKEY$:IFK$=""THEN762
763 IFK$="Y"ORK$="y"THEN1000
764 IFK$="N"ORK$="n"THENCLS:END
765 GOTO762
800 PMODE0,1:PCLEAR1:GOTO22
802 POKE282,255:CLS:IFDV=-1THENP
F$="PARTFILE":PRINT@160,"POSITIO
N TAPE. PRESS <PLAY> AND <RECORD
>. PRESS ANY KEY.":EXEC44539:K$=
INKEY$
804 IFDV=1THENPRINT@160,"SAVE PA
RTFILE NAME:";:INPUTPF$
806 OPEN"O",#DV,PF$
808 PRINT#DV,B,T,PN,LN,LP,LF
810 FORX=1TOT
812 PRINT#DV,A$(X)
814 NEXT:END
820 PRINT:PRINT"IS THIS FILE COM
PLETE? Y/N"
822 K$=INKEY$:IFK$=""THEN822
824 IFK$="Y"THEN900
826 IFK$="N"THENCLS:GOTO830
828 GOTO822
830 IFDV=-1THENPF$="PARTFILE":PR
INT@160,"POSITION TAPE. PRESS <P
LAY>.    PRESS ANY KEY.":EXEC445
39
832 IFDV=1THENPRINT@160,"LOAD PA
RTFILE NAME:";:INPUTPF$:PF$=PF$+
"/DAT"
834 OPEN"I",#DV,PF$
836 INPUT#DV,B,T,PN,LN,LP,LF
838 FORX=1TOT
840 IFEOF(DV)THEN846
842 LINEINPUT#DV,A$(X)
844 NEXT
846 CLOSE#DV
848 IFT>4THENCLS:PRINT"LAST 5 LI
NES OF FILE:":FORX=T-4TOT:PRINTA
$(X):NEXT:PRINTTAB(4)"PRESS ANY
KEY TO CONTINUE";:EXEC44539
850 IFLN=LP THENLN=0:PN=PN+1
852 CLS:GOTO150
900 CLS:IFDV=-1THENF$="FILE":PRI
NT@160,"POSITION TAPE. PRESS <PL
AY>.    PRESS ANY KEY.":EXEC4453
9:PRINTTAB(10)"LOADING FILE."
910 IFDV=1THENPRINT@160,"LOAD FI
LENAME";:INPUTF$:F$=F$+"/DAT"
920 OPEN"I",#DV,F$
930 INPUT#DV,LP,LF:N=LP*6
940 FORT=1TON+3
950 IFEOF(DV)THEN980
960 IFT>N THENLINEINPUT#DV,C$(T-
N)ELSELINEINPUT#DV,A$(T)
970 NEXT
980 CLOSE#DV
990 GOTO350
1000 POKE282,255:CLS:IFDV=-1THEN
F$="FILE":PRINT@160,"POSITION TA
PE. PRESS <PLAY> AND <RECORD>. P
RESS ANY KEY.":EXEC44539:PRINTTA
B(10)"SAVING FILE."
1010 IFDV=1THENPRINT@160,"SAVE F
ILENAME:";:INPUTF$
1020 N=LP*6
1030 OPEN"O",#DV,F$
1040 PRINT#DV,LP,LF
1050 FORT=1TON+3
1060 IFT>N THENPRINT#DV,C$(T-N)E
LSEPRINT#DV,A$(T)
1070 NEXT
1080 CLS:END
1100 CLS:FORX=1TOLP*6
1110 IFX<=LP*6THENPRINT"A$("X")=
":PRINTA$(X)
1120 IFX/5=INT(X/5)ORX=LP*6THENP
RINT"PRESS ANY KEY";:EXEC44539:C
LS
1130 NEXT
1140 GOTO350
```

Overlord

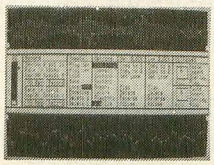
Peace through superior firepower is the catch phrase in this sophisticated wargame simulator. Victory shall not fall to he who is the mightiest, oh no, but to he who can plan ahead and develop the better strategy. You must ensure that all your troops are brought into battle at the right moment, and for that you must set your most industrialized cities to producing troop transporters. Other cities will build Aircraft carriers, fighter jets, paratroop regiments, submarines, spy planes, battleships, destroyers, and cruisers. Up to three people can play the game simultaneously, each starting out at his own base city, each knowing nothing about the strenghts and locations of his enemies' forces. The player's own combat troops will head out, exploring the world as they go, capturing towns that lie waiting, or engaging the enemy face to face. You can set any or all of the three players to be operated by the sinister silicon brain of your CoCo 3, and battle them or let them battle each other.

Price: $29 US / $34 Cdn. (Now shipping v1.1)

Overlord requires: 128k CoCo 3, 1 drive and a mouse or joystick.

Studio Works Professional: Studio quality digital audio is here!

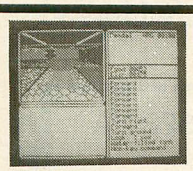
New!



NEW!

A new hardware pack developed by Oblique Triad allows our new software to record at 35kHz at eight bits wide! Your CoCo3 is now a serious, professional quality digital sampling system. The optional MIDI slave mode (cable required) lets you 'play' your CoCo from your MIDI computer or synthesizer. The built-in rigid tempo sequencer will let you lay down a useful, studio quality rythym section. New 'scale' feature lets you play any of up to 55 (512k) sounds effects directly from CoCo's keyboard, one on each row, low to high from left to right. Two zoom windows allow for perfect loop setting down to the byte. Support for Disto/CRC's 1 meg RAM card, our 8-bit output option (built into the pack), Orchestra 90CC, hires mouse. 25 seconds of CD-quality in 1 Meg! Point-and-click operation, clipboards, too many features to list! (Call for SWPro FX discs!)

Price: $95 US/$110 CDN (incl. software, demo samples, ADC pack)
(Call for prices on 8-bit output, MIDI cable, SW Pro with just cable)
Req.: 128k Coco3, (512k rec'd), multi-pak/Y-cable, mouse/joystick



the Seventh Link

The Seventh Link is still the best fantasy role-playing adventure the CoCo has ever seen, bar none. 3 discs are filled with worlds, towns castles, and spectacular 3D dungeons filled with full colour, hi-res monsters, ladders, doors and pits, chests, pools, lava and flooded rooms. You would not believe that a CoCo 3 could produce such high-speed detailed graphics. In the wild lands above, you'll find monsters, towns and castles. The towns will reveal merchants, learned locals, even friends who will join your quest. Look no further for the best in hard-core adventure.

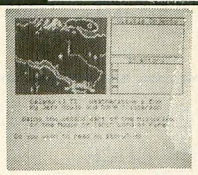
$38 US/ $48 Cdn. Req: CoCo3, 40 track drive

Caladuril II: Weatherstone's End

"Some of the best graphics to be seen on a CoCo 3" will amaze you as you attempt to discover the fate of the Weatherstone. Smooth scrolling 16 colour graphics and a sophisticated command interpreter lend realism and enjoyment to one of the most extensive adventures to be found on a CoCo. Package includes 2 discs, an 11x17" map, a velvet pouch of powerstones and a 20 page booklet.

Price: $32 US/ $38 Cdn

(Caladuril I: $18/$24, CoCo2, drive)

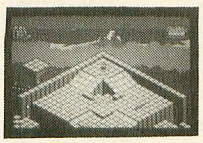


Requires: 128k CoCo 3, 1 drive.

Hint Books!

Caladuril 1 and 2 books :20 pp, $3.50. Seventh Link books are 40 pages, $5.50

Those Darn Marbles



New!

Dedicate a program to 512k machines only, and all sorts of new things are possible. Those darn Marbles is the first CoCo game to use the built-in hardware screen scrolling features of the CoCo 3. This means that all the computer's time en be dedicated to controlling the game itself (sound effects, moving objects around, eteetera) rather than the time-intensive chore of scrolling an entire 32k screen around. You will be amazed to see how smoothly a HARDWARE-scrolled screen can move. Compare Those Darn Marbles with any other 3D marble type game on any computer, and you will be convinced that your CoCo 3 really can stand with the best of them. (One of our playtesters remarked, upon seeing the pre-release version of TDM: "My Amiga isn't that smooth!") 50k of multi-tasking sound, nearly 1 meg of graphics add excitement!

Our new 2-stage compression routine squeezes 1.1M onto 4 discs!

It's been said many times, but this time it's true: Your CoCo 3 game library is not complete without a copy of Those Darn Marbles. Your 512k CoCo 3 never looked so good!

Price $32 US / $38 Cdn. Requires: 512k CoCo 3,1 drive,joystick.

Come and see us at Rainbowfest Chicago!

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Four projects using the 4PDT switch

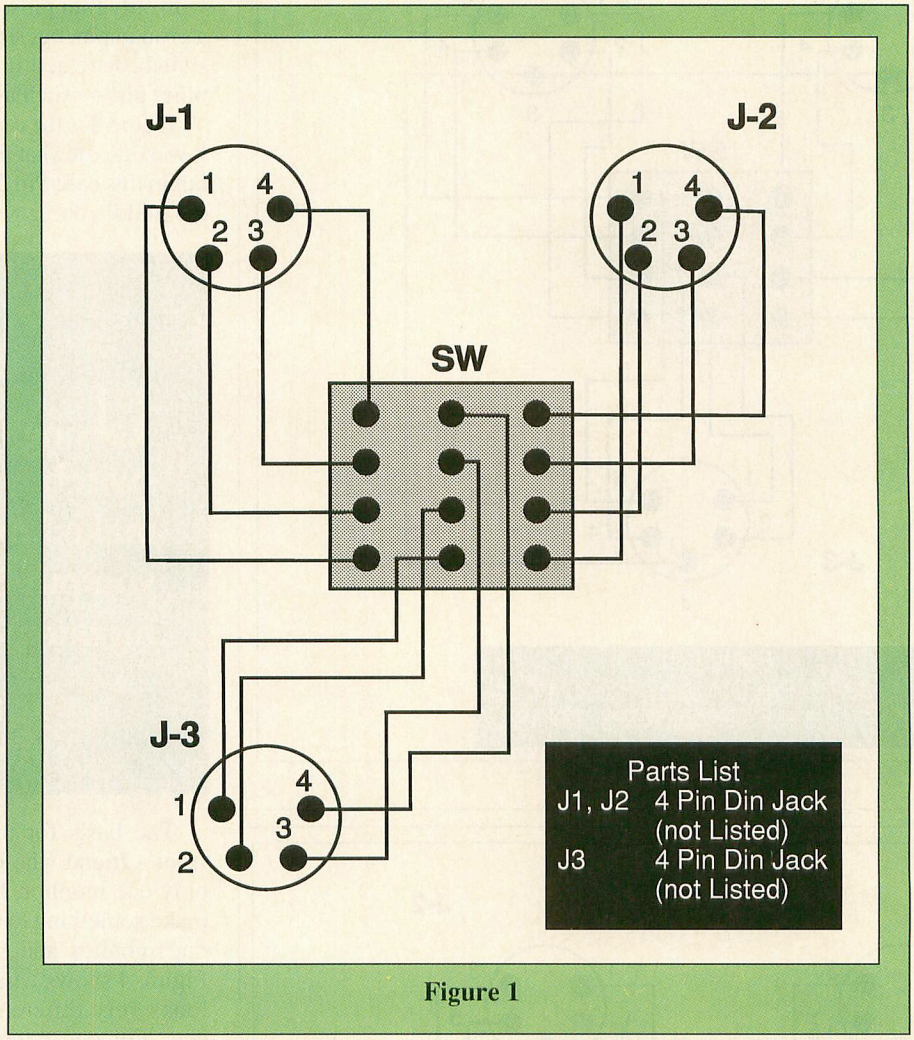


Figure 1

A Special Switch

by Neophytos Iacovou

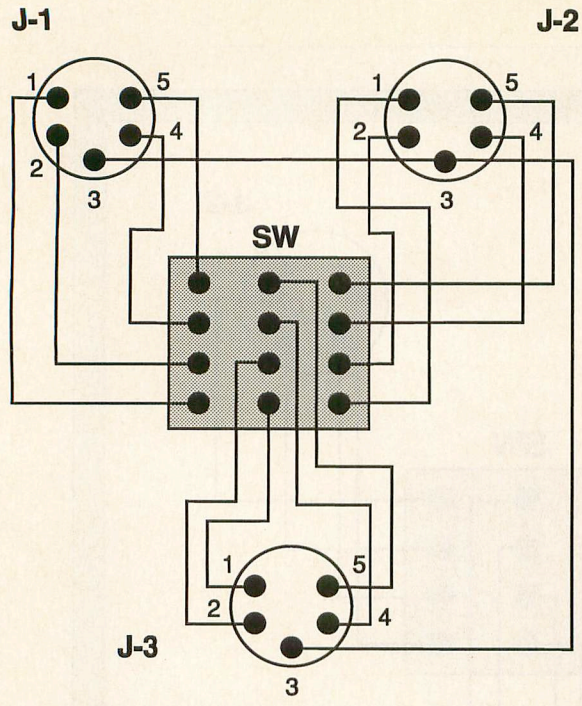
I recently found myself at a local electronics store. As I was looking around trying to find parts, I stumbled across a special switch that lets you perform four useful functions on the CoCo. This switch is the 4PDT (Four Pole, Double Throw) switch.

Using the 4PDT switch, you can make boxes that let you put two devices on one port. For example, you can hook up a mouse and joystick using the box to switch between the two peripherals. The most popular of these boxes is the serial switcher, which enables the user to switch between a modem and printer (or similar items) hooked to the serial port.

Let's take a look at the four projects. (SW in all schematics is the 4PDT switch.) Figure 1 shows the schematic for the serial switcher. As you can see, every pin is connected onto the switch; J-1 and J-2 are the input ports, and J-3 is the output that connects to the CoCo. This is the easiest of the four projects to build, and I recommend constructing it first if you are going to build all four.

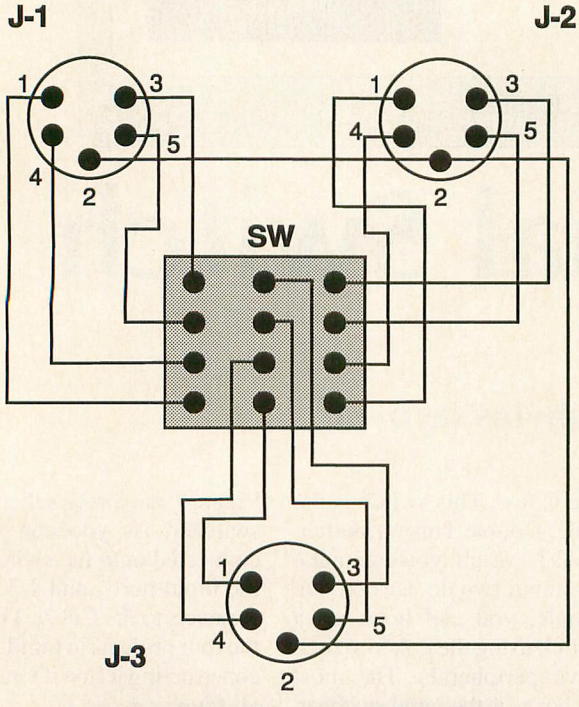
Figure 2 shows the schematic for the joystick switcher. As you see, the joystick port has five pins rather than four like the serial port. (The CoCo 3 uses 6 pins on its joystick ports so you'll need to make other

Neophytos Iacovou has owned a CoCo since 1982. He is an active member of the Metropolitan Color Computer User's Group and is pursuing a bachelor's degree in electrical engineering. You can contact Neophytos at 116 West 27 St., Minneapolis, MN 55408.



Parts List	
J1, J2	6 Pin Din Jack RS-274-021
J3	6 Pin Din Jack RS-274-020

Figure 2



Parts List	
J1, J2	5 Pin Din Jack RS-274-003
J3	5 Pin Din Jack RS-274-006

Figure 3

alterations to switch joysticks on it.) You may think you will get into trouble, but Pin 3 is the ground pin. With this knowledge you can connect all the ground pins together. So now you are actually dealing with only four pins. The serial port also has a ground pin, but since we had room on the switch, I treated it as though it were any other pin — such as Data Receive.

Figure 3 is the cassette recorder switcher. It works somewhat like the joystick switcher, but in this case Pin 2 is the ground (it is still the middle one).

Using the 4PDT switch, you can make boxes that let you put two devices on one port.

The basis for the next project comes from a friend who has CoCos 2 and 3 but only one monitor. He asked me if I could make something to hook two computers to one monitor and switch between them. Figure 4 shows what I came up with. This looks very different from the other projects. For one thing, J-1 is the input that accepts two computers (instead of one computer accepting two peripherals). Look at the schematic for a while and you'll see that it's very friendly. When you get J-1, it is a long strip of plastic with four RCA jacks. Here the audio and video from each computer are plugged in. J-2 and J-3 are plugged into the monitor (these are RCA plugs too). On each plug are two pins. We use two rows for the audio and the other two rows for the video switch.

That is all you need to assemble the projects. Here are some tips for construction: Make all wires long enough to reach your peripherals, using heat-shrinkable tubing to give your projects that extra touch. If you are going to build more than one project, don't mount them separately; a longer case can be placed on top of your CoCo for a better look. The price of each project is about $11, but if you build them all, you can get the cost down to $8 apiece if you shop carefully.

❑

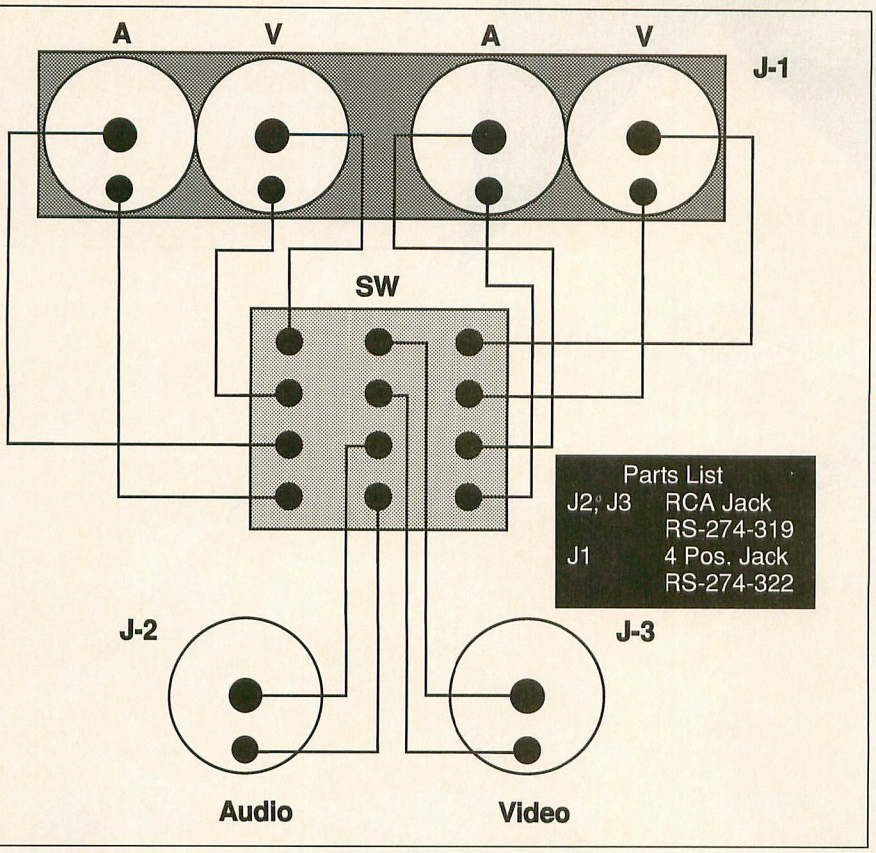
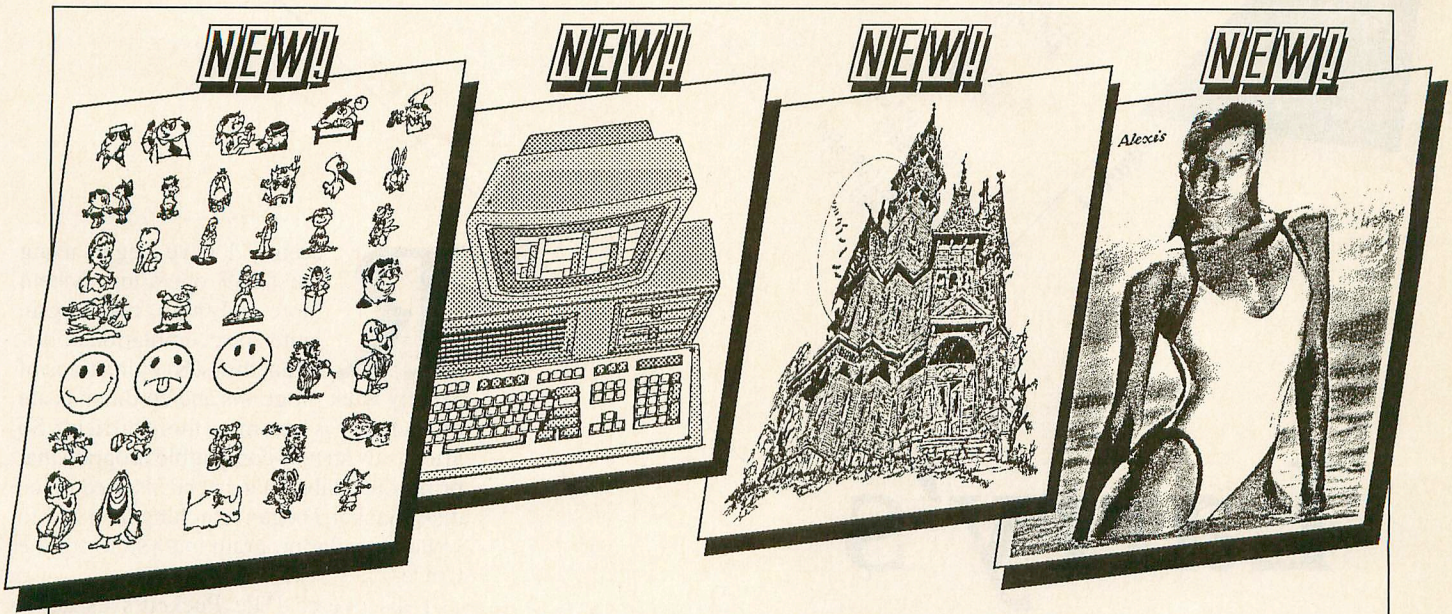


Figure 4

CORRECTIONS

"Moon Mapper"(March 1990, Page 82): Two incorrect figures were published in the table for the Galilean satelites. First, the rotation period for the Moon should be 27d 7h 43m. Also, the average distance from Europa to Jupiter should be 416,691 miles.

"The Total Figure"(February 1990, Page 26): The save and load functions do not work with Disk Extended Color BASIC version 1.0. We are currently working on a solution to this problem and will publish a correction as soon as possible.



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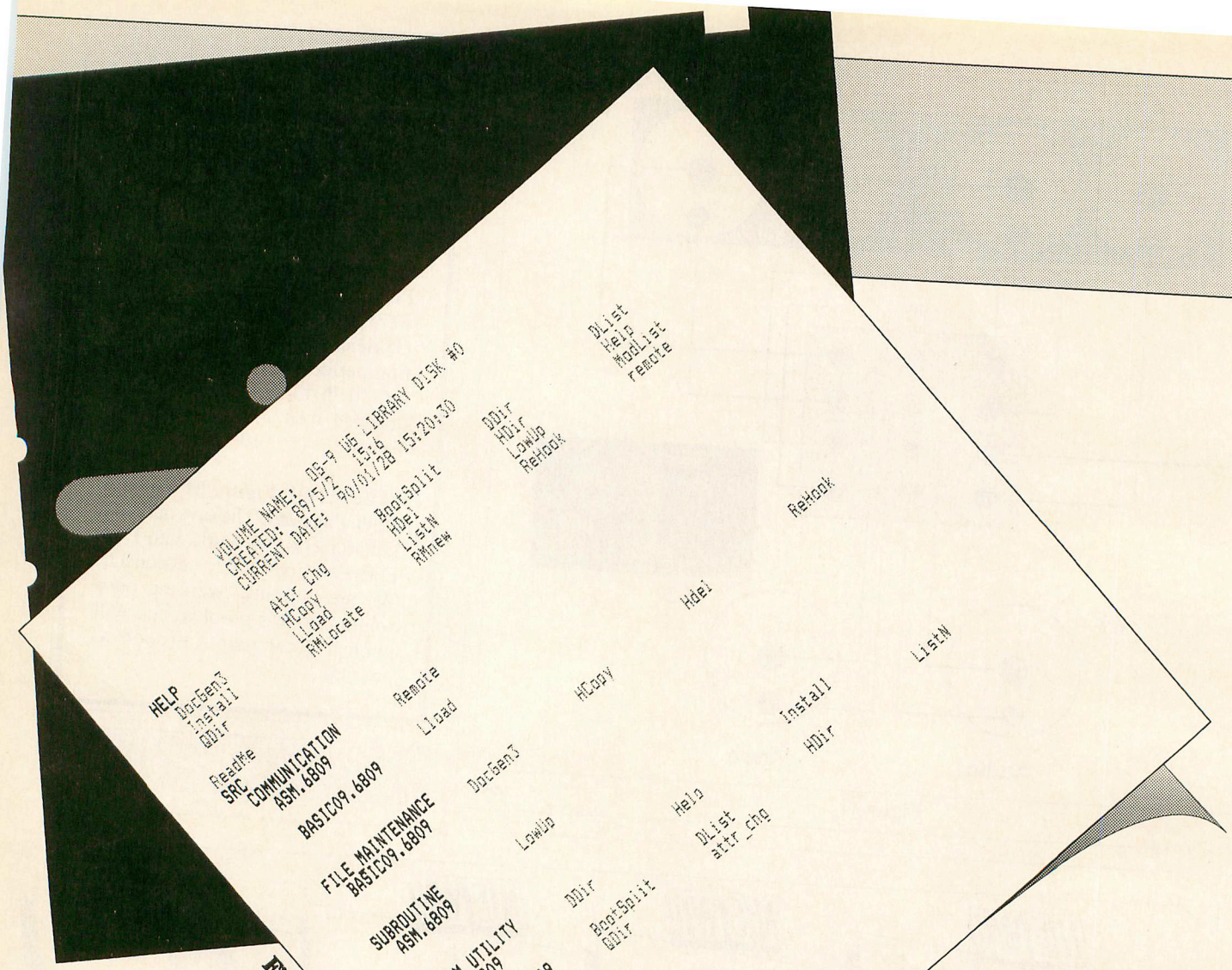


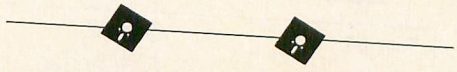
Figure 1

Larry's Labeler

by Larry Pittman

Recently I have begun using the OS-9 operating system more and more, resulting in quite an accumulation of different disks. Keeping track of exactly what programs and commands are on each disk is becoming more difficult. So after I saw an IBM-compatible program that prints out a label that can be inserted in the disk's jacket, I began searching for a way to write a similar program in BASIC09 for the CoCo.

I discovered Dale Puckett's usage of recursive programs to search through a



Larry Pittman works as an electrical engineer for General Motors. He enjoys programming the CoCo and has written many programs for his own use. He can be contacted at 11406 Majorca Place, Fenton, MI 48430.

Add a sense of order to your collection of floppy disks

disk's directory in the June 1989 issue of THE RAINBOW. These programs became the starting point for the two included BASIC09 programs, `pdir` and `dlabel`. The programs require a printer and will print a label approximately 5¼ inches square, which can be cut out and placed in the disk jacket for ready reference. The label contains the volume name, the date created, the current date and all files and directories on the disk. Each directory name is printed in bold letters, and each group of files in that directory is indented from the parent directory. The program is capable of handling directories five levels deep without problems. Although the program will run with deeper directories, this may disturb the right margin of the label.

A sample printout of the program is shown in Figure 1. Under ideal situations, a maximum of 170 files and directory names can be handled without disturbing the label size. The length of filenames and number of files per directory will probably cause the actual maximum to be less than this. If a label is printed out with additional files or directory names, it is longer than normal and can be folded to fit in the disk jacket. In addition, a notice is printed on-screen that such a label has been printed.

Operation

After entering and packing these two procedures into your commands directory, merge them together into a common file named `dlabel`. You must do this if you are running a single drive system. Also be certain that `runb` is in your commands directory. If the files are merged, remember to enter `attr dlabel e pe` to allow execution of the newly-merged file.

The program starts with a default of `/d0` as the initial disk to be read. Pressing ENTER at the initial prompt starts the program reading Drive `/d0`. If you want, you can enter `/d1`, `/d2` or any other valid drive on your system. Whatever drive you choose is retained as the default drive for additional disk labels that you print. However, you can always change it later if you want. You can change the startup default by changing `/d0` in Offset $008B of `dlabel`. If you examine the program, you'll notice a 32-character string is reserved for the drive name. You are therefore free to specify a specific directory instead of the entire disk as long as the pathname does not exceed 32 characters.

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Make certain your printer is ready prior to starting your program, and also that it is set to begin at the top of the page. If it is not turned on, the program defaults to the start-up prompt. Two labels fit on a standard page before the program advances the printer to the top of the next page. See the notes below on setting up for your printer.

The programs require a printer and will print a label approximately 5¼ inches square, which can be cut out and placed in the disk jacket for ready reference.

Printer Setup

The program is set to run with a Star NX-10 printer. You may need to modify the program to run with your printer. The program uses the following codes:

Function	Codes	Program/Offset
17 cpi	27;15	dlabel - $01AF
8 lines/in	27;48	dlabel - 01DD
form feed	12	dlabel - 03EO
reset 10 cpi	18	dlabel - 040D
6 lines/in	27;50	dlabel - 0438
bold on	27;71	pdir - 02OD
bold off	27;72	pdir - 0252

You should be aware of the program's use of the Bold-On/Bold-Off commands in pdir since its action may be different on your printer. The program uses the PRINT TAB() function to properly position the printhead. Unfortunately, the characters sent to the printer are counted by BASIC09 to determine the number of spaces to print for the tab. To correct this problem, Offset $0234 sets ptab=5 instead of the normal ptab=3 due to the two codes sent to turn bold on. Likewise, Offset $0285 sets rtmar=96 instead of the normal rtmar=92 due to the two codes sent to turn bold on and the two codes sent to turn bold off. If your printer uses a different number of codes to turn bold on or off, you may need to adjust these lines.

❑

OS-9

The Listing: dlabel

```
PROCEDURE dlabel
 0000       DIM pathname,disk,dname:STRING
 000F       TYPE record=yr,mo,d,h,mi,vol(32):BYTE
 0033       DIM volid:record
 003C       DIM DirLevel,ppath,vpath,lines:BYTE
 004F       DIM ans:STRING[1]
 005B       DIM count,ptab,rtmar,char:INTEGER
 006E       DIM labels:REAL
 0075       ON ERROR GOTO 400
 007B       en=0
 0083       labels=0
 008B       pathname="/d0"
 0095       REPEAT
 0097         labels=labels+1
 00A3         PRINT CHR$(12)
 00A8         PRINT "  DISK LABEL MAKER"
 00BE         PRINT  \ PRINT
 00C2         PRINT "Enter Drive to Read:  [";pathname;"]";
 00E6         INPUT disk
 00EB         IF disk="" THEN
 00F7           disk=pathname
 00FF         ELSE
 0103           pathname=disk
 010B         ENDIF
 010D         PRINT  \ PRINT "Reading:  ";pathname
 0121         disk=disk+"@"
 012D         OPEN #vpath,disk:READ
 0139         SEEK #vpath,26
 0142         GET #vpath,volid
 014C         CLOSE #vpath
 0152         char=0
 0159         dname=""
 0160         REPEAT
 0162           char=char+1
 016D           dname=dname+CHR$(LAND(volid.vol(char),127))
 0183         UNTIL char=32 OR volid.vol(char)>127
 019B         DirLevel=0
 01A2         OPEN #ppath,"/p":WRITE
 01AF         PRINT #ppath,CHR$(27); CHR$(15);  \(* Set print for condensed type
 01DD         PRINT #ppath,CHR$(27); CHR$(48);  \(* Set print for 8 lines/in
 0207         FOR count=1 TO 91
 0217           PRINT #ppath,"-";
 0222         NEXT count
 022D         PRINT #ppath,"-"
 0237         PRINT #ppath,"|"; TAB(92); "|"
 0249         PRINT #ppath,"|"; TAB(20); "VOLUME NAME:  "; dname; TAB(92); "|"
 0274         PRINT #ppath,"|"; TAB(20); "CREATED:  "; volid.yr; "/"; volid.mo;
   "/"; volid.d; "   "; volid.h; ":"; volid.mi; TAB(92); "|"
 02CC         PRINT #ppath,"|"; TAB(20); "CURRENT DATE:  "; DATE$; TAB(92); "|"
 02F6         PRINT #ppath,"|";
 0301         lines=4
 0308         rtmar=92
 030F         ptab=81
 0316         CLOSE #ppath
 031C         ON ERROR GOTO 300
 0322         RUN pdir(pathname,DirLevel,lines,ptab,rtmar)
 0340 300     OPEN #ppath,"/p":WRITE
 0350         ON ERROR GOTO 400
 0356         PRINT #ppath,TAB(rtmar); "|"
 0365         lines=lines+1
 0370         FOR count=lines TO 39
 0381           PRINT #ppath,"|"; TAB(92); "|"
 0393         NEXT count
 039E         FOR count=1 TO 92
 03AE           PRINT #ppath,"-";
 03B9         NEXT count
 03C4         PRINT #ppath
 03CA         IF INT(labels/2)=labels/2 THEN
 03E0           PRINT #ppath,CHR$(12) \(* Advance printer to top of page
 040B         ENDIF
 040D         PRINT #ppath,CHR$(18);  \(* Reset printer to normal print
 0438         PRINT #ppath,CHR$(27); CHR$(50);  \(* Reset printer to 6 lines per
   inch
 046B         CLOSE #ppath
 0471         IF lines>39 THEN
 047D           PRINT "Note-Overlength label printed!"
 04A0         ENDIF
 04A2         PRINT "Done...Another Label? [Y/n]";
 04C2         INPUT ans
 04C7 400     en=ERR
 04D1         IF en=2 THEN
 04DE           END
 04E0         ENDIF
 04E2       UNTIL ans="n" OR ans="N"
 04F6       END
```

```
PROCEDURE pdir
 0000      PARAM pathname:STRING; DirLevel,lines:BYTE; ptab,rtmar:INTEGER
 001B      TYPE record=fname(29):BYTE; lsn3,lsn2,lsn1:BYTE
 0039      DIM fmentry:record
 0042      DIM DirEntry:STRING[29]
 004E      DIM index,char,count:INTEGER
 005D      DIM en,dpath,ppath:BYTE
 006C      DIM tempdir:STRING
 0073      ON ERROR GOTO 3010
 0079      OPEN #ppath,"/p":WRITE
 0086      en=0
 008D      index=0
 0094      CHD pathname
 0099      OPEN #dpath,pathname:READ+DIR
 00A5      REPEAT
 00A7        SEEK #dpath,index \ GET #dpath,fmentry
 00BB        IF fmentry.fname(1)=0 THEN
 00CC          DirEntry="*"
 00D4        ELSE
 00D8          char=0
 00DF          DirEntry=""
 00E6          REPEAT
 00E8            char=char+1
 00F3            DirEntry=DirEntry+CHR$(LAND(fmentry.fname(char),127))
 0109          UNTIL fmentry.fname(char)>127 OR char=29
 0121          DirEntry=DirEntry+""
 012C        ENDIF
 012E        IF DirEntry<>".." AND DirEntry<>"." AND DirEntry<>"*" THEN
 014C          GOSUB 3000
 0150        ENDIF
 0152        index=index+32
 015D      UNTIL EOF(#dpath)
 0166      PRINT #ppath,TAB(rtmar); "|"
 0175      lines=lines+1
 0180      rtmar=92
 0187      PRINT #ppath,"|";
 0192      CLOSE #dpath
 0198      ptab=81
 019F      CLOSE #ppath
 01A5      END
 01A7 3000 ON ERROR GOTO 3010
 01B0      en=0
 01B7      CHD DirEntry
 01BC 3010 en=ERR
 01C5      IF en=2 THEN END
 01D2      ENDIF
 01D4      IF en=0 THEN
 01E0        tempdir="."
 01E8        PRINT #ppath,TAB(rtmar); "|"
 01F7        lines=lines+1
 0202        PRINT #ppath,"|";
 020D        PRINT #ppath,CHR$(27); CHR$(71);  \(* Turn on Bold printing
 0234        ptab=5
 023B        PRINT #ppath,TAB(DirLevel*2+ptab); DirEntry;
 0252        PRINT #ppath,CHR$(27); CHR$(72);  \(* Turn off Bold printing
 027A        DirLevel=DirLevel+1
 0285        rtmar=96
 028C        IF LEN(DirEntry)>14 THEN
 0299          ptab=39
 02A0        ELSE
 02A4          ptab=23
 02AB        ENDIF
 02AD        RUN pdir(tempdir,DirLevel,lines,ptab,rtmar)
 02CB        CHD ".."
 02D1        DirLevel=DirLevel-1
 02DC      ELSE
 02E0        IF ptab>80 THEN
 02EC          PRINT #ppath,TAB(rtmar); "|"
 02FB          lines=lines+1
 0306          PRINT #ppath,"|";
 0311          rtmar=92
 0318          ptab=3
 031F        ENDIF
 0321        IF LEN(DirEntry)>14 THEN
 032E          IF LEN(DirEntry)+ptab>90 THEN
 033F            PRINT #ppath,TAB(92); "|"
 034D            lines=lines+1
 0358            PRINT "|";
 035E            ptab=3
 0365          ENDIF
 0367          PRINT #ppath,TAB(DirLevel*2+ptab); DirEntry;
 037E          ptab=ptab+32
 0389          RETURN
 038B        ENDIF
 038D        PRINT #ppath,TAB(DirLevel*2+ptab); DirEntry;
 03A4        ptab=ptab+16
 03AF        RETURN
 03B1      ENDIF
 03B3      RETURN
```


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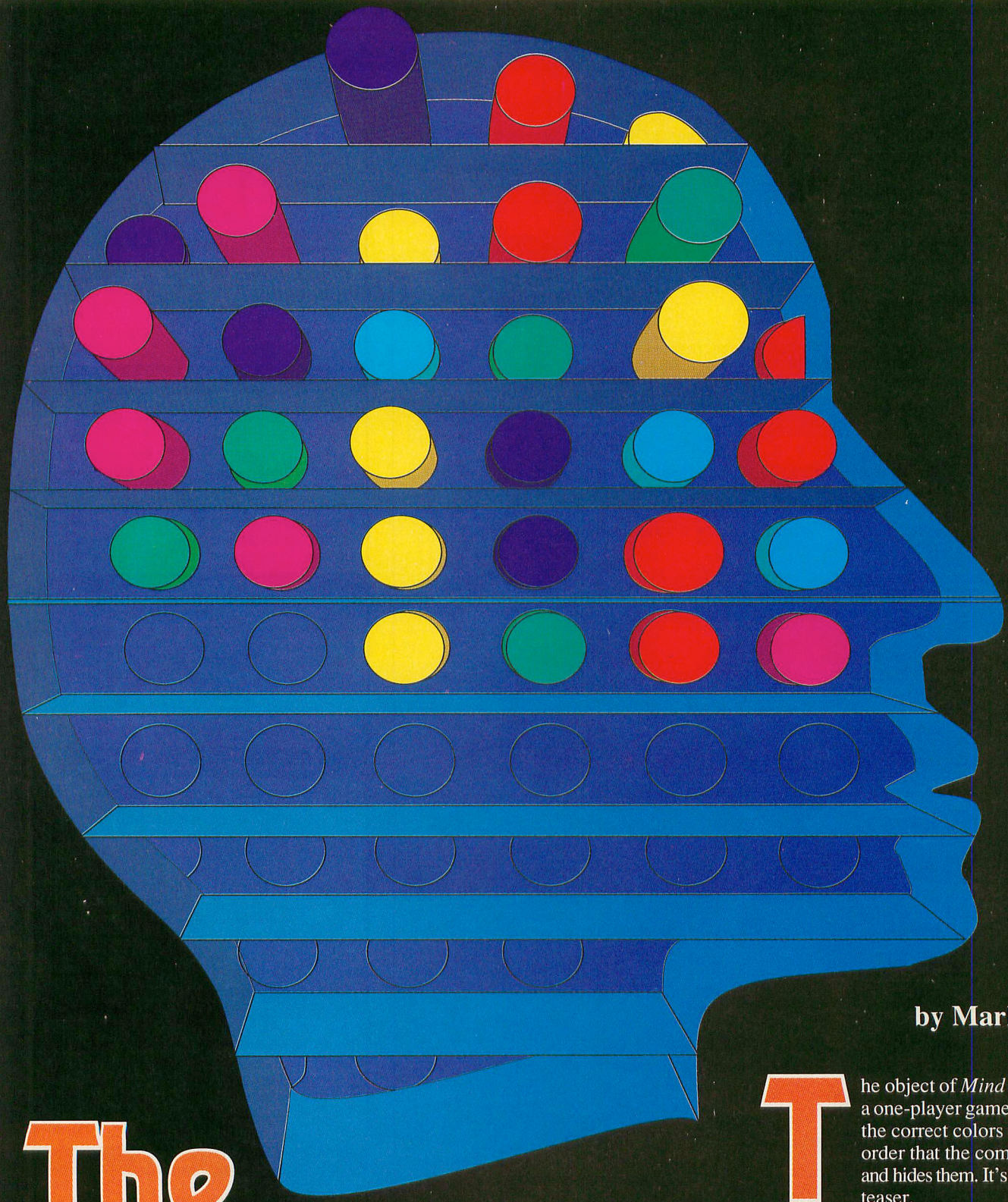


The Guessing Game

A game requiring patience and logic

by Mark Webb

The object of *Mind Stimulator*, a one-player game, is to guess the correct colors in the same order that the computer picks and hides them. It's a real mind-teaser.

There are eight levels of difficulty . These affect the number of pegs and the number of colors the computer chooses from and whether or not the computer can use a color only once (no doubles) or more than once (doubles).

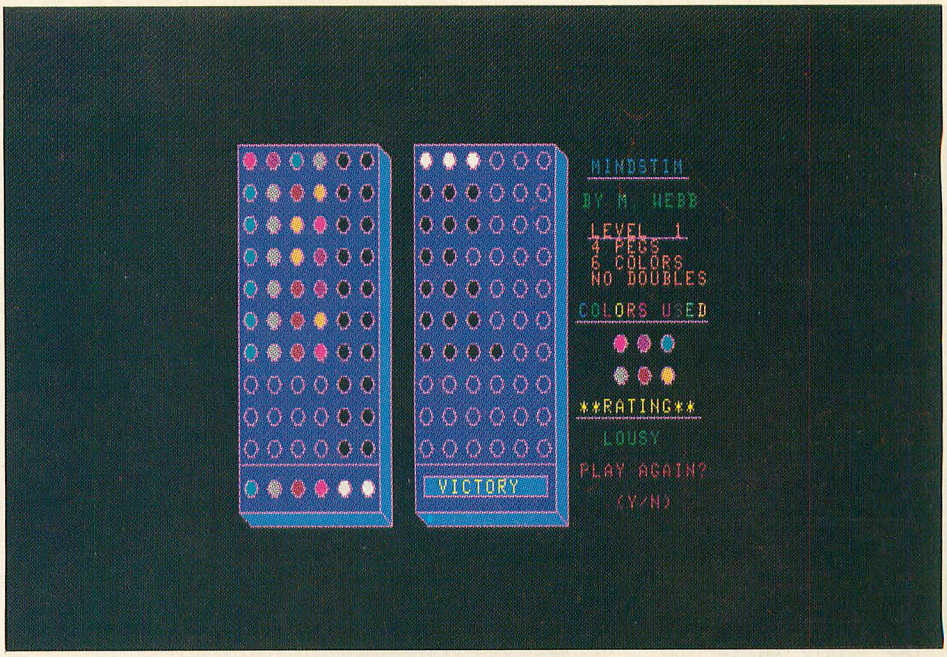
Mark Webb has been programing on the CoCo for eight years. His hobbies include motorbike riding, skiing and woodworking. You can contact Mark at P.O. Box 793, Gold River, B.C., Canada, V0P 1G0.

CoCo 3

```
110 ..... 2
170 ..... 152
250 ..... 63
370 ..... 76
450 ..... 135
530 ..... 247
610 ..... 238
690 ..... 103
780 ..... 223
850 ..... 176
930 ..... 159
1040 ..... 245
1160 ..... 25
1270 ..... 111
1380 ..... 96
1480 ..... 184
1590 ..... 171
1690 ..... 110
1770 ..... 112
1830 ..... 83
1920 ..... 7
2010 ..... 109
END ..... 94
```

The Listing: MINDSTIM

```
0 ' COPYRIGHT 1990 FALSOFT, INC
10 '*MINDSTIM*
20 'BY MARK WEBB
30 'JANUARY 1990
```



The screen is divided into two boards that hold the colored pegs. At the bottom of the left board are the computer's hidden colors (covered with white). The left board is used for the player's peg-color guesses. The left/right arrow keys move the cursor (a box) left or right over the peg holes, and the up/down arrow keys scroll through the available colors from which the pegs are chosen. The colors for the pegs are in palette slots 6 to 15 and are located in a data statement in Line 130. These can be changed by composite monitor and TV users if the colors are too similar. You can also change the RGB statement in Line 2100 to CMP .

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```
40 '
50 POKE65497,0
60 CLEAR1000
70 DIM X,Y,Z,A$,I$,PC(15),L(8,3)
,LV,XA,YA,V(40),M(6),C,N(6),RT$(
15),TE(6),TD(6)
80 HSCREEN2:HCLS0
90 PLAY"T255L255V31"
100 FORX=1 TO 4:HBUFFX,400:NEXTX
110 DATA BRAIN,WIZARD,CLEVER,GEN
UIS,SUPER,GREAT,SMART,NOT BAD,GO
OD,FINE,PAR,SO-SO,POOR,LOUSY,NOI
D,CARROT
120 FORX=15 TO 0 STEP-1:READ RT$
(X):NEXT
130 DATA 0,43,8,63,11,16,32,54,3
8,44,56,40,7,23,52,24
140 FORX=0 TO 15:READPC(X):PALET
TEX,PC(X):NEXT
150 DATA 4,6,0,4,6,1,4,8,0,4,8,1
,6,8,0,6,8,1,6,10,0,6,10,1
160 FORX=1 TO 8:FORY=1 TO 3:READ
 L(X,Y):NEXTY,X
170 FORX=0 TO 7:POKE&HF09D+520+X
,255:NEXTX:'CHR$(97)
180 'TITLE ANIMATION
190 HGET(120,80)-(184,88),1:HCOL
OR4
200 HPRINT(15,10),"MINDSTIM":HGE
T(120,80)-(184,88),2
210 HGET(112,96)-(192,104),3:HCO
LOR5
220 HPRINT(14,12),"BY M. WEBB":H
GET(112,96)-(192,104),4
230 FORX=1 TO 50:PALETTE4,RND(8)
+22:SOUNDRND(50)+150,1:NEXT
240 PALETTE4,11
250 GOTO480
260 Y=80:XA=120:YA=Y
270 FORX=120 TO 176 STEP2
280 HPUT(XA,YA)-(XA+64,YA+8),1,P
SET:HPUT(X,Y)-(X+64,Y+8),2,PSET
290 XA=X
300 NEXT
310 FORX=176 TO 248 STEP2
320 HPUT(XA,YA)-(XA+64,Y+8),1,PS
ET:HPUT(X,Y)-(X+64,Y+8),2,PSET
330 XA=X:YA=Y:Y=Y-2
340 NEXT
350 Y=Y+2
360 FORX=248 TO 240 STEP-2
370 HPUT(XA,Y)-(XA+64,YA+8),1,PS
ET:HPUT(X,Y)-(X+64,Y+8),2,PSET:X
A=X
380 NEXTX
390 HCOLOR1:HLINE(238,17)-(306,1
7),PSET
400 Y=96:XA=112:YA=Y
410 FORX=112 TO 233 STEP2
420 HPUT(XA,YA)-(XA+80,YA+8),3,P
SET:HPUT(X,Y)-(X+80,Y+8),4,PSET:
XA=X
430 NEXT
440 FORY=95 TO 24 STEP-2
450 HPUT(XA,YA)-(XA+80,YA+8),3,P
SET:HPUT(X,Y)-(X+80,Y+8),4,PSET:
YA=Y
460 NEXT
470 RETURN
480 HCOLOR6:HPRINT(8,15),"USE (L
-R) ARROW KEYS TO"
490 HPRINT(8,16),"CHOOSE LEVEL &
 HIT ENTER"
500 LV=1:A$=STRING$(10,97):GOTO5
80
510 'CHOOSE LEVEL HERE
520 I$=INKEY$:IFI$=""THEN520
530 IF I$=CHR$( 8) AND LV>1 THEN
 LV=LV-1:GOTO580
540 IF I$=CHR$(9) AND LV<8 THEN
LV=LV+1:GOTO580
550 IF I$=CHR$(13) THEN 640
560 PLAY"O3GBGO4BG"
570 GOTO520
580 HCOLOR0:FORY=18 TO 21:HPRINT
(14,Y),A$:NEXT
590 HCOLOR8:I$=RIGHT$(STR$(L(LV,
1)),1)+" PEGS":HPRINT(14,19),I$
600 I$="LEVEL "+STR$(LV):HPRINT(
14,18),I$
610 X=LEN(STR$(L(LV,2)))-1:I$=RI
GHT$(STR$(L(LV,2)),X)+" COLORS":
HPRINT(14,20),I$
620 IF L(LV,3)=0 THEN I$="NO DOU
BLES" ELSE I$="DOUBLES"
630 HPRINT(14,21),I$:GOTO520
640 GOSUB260:HCOLOR0:X=64:XA=256
650 FORZ=1 TO 15:PLAY"O4DCDCDCV-
V-":NEXT:PLAY"V31"
660 FORY=0 TO 16 STEP2
670 HLINE(X,Y+120)-(XA,Y+120),PS
ET:HLINE(X,135-Y)-(XA,135-Y),PSE
T
680 NEXT
690 FORX=1 TO 40:V(X)=X:NEXTX
700 FORX=1 TO 50
710 A=RND(40):B=RND(40):IF B=A T
HEN710
720 C=V(A):V(A)=V(B):V(B)=C
730 NEXT
740 FORX=1 TO 40
750 A=0
760 IF V(X)>10 THEN V(X)=V(X)-10
:A=A+1:GOTO760
770 XA=(13+V(X))*8-1:YA=(18+A)*8
-1:HGET(XA,YA)-(XA+8,YA+8),1
780 HCOLOR0:HPRINT(13+V(X),18+A)
,CHR$(97)
790 XA=(29+V(X))*8-1:YA=(5+A)*8-
1:HPUT(XA,YA)-(XA+8,YA+8),1,PSET
800 NEXTX
810 HCOLOR1:HLINE(238,47)-(305,4
7),PSET
820 I$="NR96D160NR96D24NR96F8R96
NH8U184H8D184"
830 HDRAW"BM0,0;C1;XI$;":HPAINT(
1,1),2,1:HPAINT(1,162),2,1
840 HPAINT(8,186),4,1:HPAINT(98,
8),4,1
850 HDRAW"BM120,0;XI$;":HPAINT(1
21,1),2,1:HPAINT(121,162),2,1
860 HPAINT(128,186),4,1:HPAINT(2
18,8),4,1
870 FORY=8 TO 152 STEP 16
880 FORX=8 TO 88 STEP 16
890 HCIRCLE(X,Y),5,1:HCIRCLE(X+1
20,Y),5,1
900 NEXTX,Y
910 FORX=8 TO 88 STEP 16:HCIRCLE
(X,172),5,1:NEXT
920 HCOLOR4:HLINE(127,167)-(209,
176),PSET,BF:HCOLOR1:HLINE(126,1
66)-(210,176),PSET,B
930 I$="COLORS USED"
940 FORX=1 TO LEN(I$)
950 A$=MID$(I$,X,1):HCOLOR3+X:HP
RINT(28+X,10),A$:PLAY"O3BGB"
960 NEXTX
970 HCOLOR1:HLINE(230,89)-(320,8
9),PSET
980 Z=L(LV,2)/2:IFZ=4 THEN XA=25
2:GOTO1010
990 IF Z=5 THEN XA=244:GOTO1010
1000 IF Z=3 THEN XA=260
1010 FORX=1 TO 10:V(X)=0:NEXTX
1020 V(1)=RND(10)+5
1030 FORX=2 TO Z*2
1040 Y=RND(10)+5
1050 FORW=1 TO X-1
1060 IF Y=V(W) THEN1040
1070 NEXTW
1080 V(X)=Y
1090 NEXTX
1100 Z=XA+(Z*16)-16:YA=100:C=1:H
COLOR1
1110 FORY=0 TO 1
1120 FORX=XA TO Z STEP 16
1130 HCIRCLE(X,YA+(Y*16)),5,1:HP
AINT(X,YA+(Y*16)),V(C),1:C=C+1
1140 NEXTX,Y
1150 'CHOOSE HIDDEN PEGS
1160 M(1)=V(RND(L(LV,1)))
1170 FORX=2 TO L(LV,1)
1180 Y=V(RND(L(LV,2)))
1190 IF L(LV,3)=1 THEN 1230
1200 FORZ=1 TO X-1
1210 IF Y=M(Z) THEN1180
1220 NEXTZ
1230 M(X)=Y
1240 NEXTX
1250 FORX=1 TO 50
1260 Z=(RND(L(LV,1))*16)-8:HPAIN
T(Z,172),5+RND(10),1:SOUND 50+RN
D(100),1
1270 NEXTX
1280 FORX=8 TO 88 STEP16:HPAINT(
X,172),3,1:NEXTX
1290 HCOLOR7:HPRINT(17,21),"ROUN
D 1"
1300 IF L(LV,1)=6 THEN1340
1310 FORY=8 TO 152 STEP16
1320 HPAINT(72,Y),0,1:HPAINT(88,
Y),0,1
1330 NEXT
1340 R=0:C=1:P=1:I$=INKEY$
1350 'MAIN LOOP
1360 I$=INKEY$:A$=STRING$(8,97)
1370 X=((P-1)*16)+1:Y=(R*16)+1
1380 HCOLOR5:HLINE(X,Y)-(X+14,Y+
14),PSET,B
1390 HCOLOR2:HLINE(X,Y)-(X+14,Y+
14),PSET,B
1400 IF I$="" THEN1360
1410 IF I$=CHR$(94) THEN C=C+1
1420 IF I$=CHR$(10) THEN C=C-1
1430 IF I$=CHR$(9) THEN P=P+1:PL
AY"O4FFF":GOTO1520
1440 IF I$=CHR$(8) THEN P=P-1:PL
AY"O4FFF":GOTO1520
1450 IF I$=CHR$(13) THEN 1550
1460 PLAY"O2CB"
1470 IF C>L(LV,2) THEN C=1
1480 IF C<1 THEN C=L(LV,2)
1490 IF P<1 THEN P=L(LV,1)
1500 IF P>L(LV,1) THEN P=1
1510 N(P)=V(C):HPAINT((P*16)-8,(
(R+1)*16)-8),V(C),1
1520 IF P<1 THEN P=L(LV,1)
1530 IF P>L(LV,1) THEN P=1
1540 GOTO1360
1550 'ANALYZE COLORS PICKED
1560 FORX=1 TO 6:TD(X)=M(X):TE(X
)=N(X):NEXT
1570 W=0:B=0
1580 FORX=1 TO L(LV,1)
1590 IF TD(X)=TE(X) THEN B=B+1:T
E(X)=0:TD(X)=77
1600 NEXT
1610 FORX=1 TO L(LV,1)
1620 FORY=1 TO L(LV,1)
1630 IF TD(X)=TE(Y) THEN W=W+1:T
```

```
E(Y)=0:TD(X)=77:GOTO1650
1640 NEXTY
1650 NEXTX
1660 'DISPLAY RESULTS
1670 IF B=0 THEN1720
1680 FORX=1 TO B
1690 HPAINT(128+(X-1)*16,8+R*16)
,0,1:PLAY"05BGBGCCC"
1700 NEXT
1710 IF B=L(LV,1) THEN1800
1720 IF W=0 THEN1760
1730 FORX=B TO B+W-1
1740 HPAINT(128+X*16,8+R*16),3,1
:PLAY"03GAGAGA"
1750 NEXT
1760 IF W=0 AND B=0 THEN PLAY"01
FABCFABCFABC"
1770 R=R+1:IFR=10 THEN HCOLOR4:H
PRINT(17,21),STRING$(8,97):HCOLO
R7:HPRINT(17,21),"YOU LOSE":GOTO
1820
1780 HCOLOR4:HPRINT(17,21),A$:I$
="ROUND"+STR$(R+1):HCOLOR7:HPRIN
T(17,21),I$
1790 GOTO1360
1800 'WIN
1810 HCOLOR4:HPRINT(17,21),A$:HC
OLOR7:HPRINT(17,21),"VICTORY"
1820 FORX=1 TO L(LV,1):HPAINT(8+
(X-1)*16,172),M(X),1:NEXT
1830 FORX=1 TO 3:PLAY"04CEGBO5DF
A":NEXT
1840 HCOLOR7:HPRINT(29,16),"**RA
TING**"
1850 HCOLOR1:HLINE(230,137)-(314
,137),PSET
1860 HCOLOR5:RT=7+LV-R
1870 IF R=10 THEN RT=0
1880 HPRINT(31,18),RT$(RT)
1890 HCOLOR6:HPRINT(29,20),"PLAY
 AGAIN?"
1900 HPRINT(32,22),"(Y/N)":I$=IN
KEY$
1910 I$=INKEY$:IFI$=""THEN1910
1920 IF I$<>"N" AND I$<>"Y" THEN
1910
1930 IF I$="Y" THEN RESTORE:POKE
65497,0:HCLS0:GOTO110
1940 'END
1950 HCLS0
1960 DATA 0,2,8,10,12,32,36,38,4
0,44,46,54,63
1970 FORX=0 TO 12:READA:PALETTEX
,A:NEXTX
1980 R=10:X=155:Y=91:PI=57.29577
951:C=1
1990 FORZ=0 TO 360 STEP 10
2000 HCOLORINT(C):C=C+.333333331
2010 FORW=0 TO 3
2020 A=(Z+W*90)/PI:CX(W)=X-SIN(A
)*R:CY(W)=Y-COS(A)*R:R=R+.5
2030 NEXTW
2040 HLINE(CX(0),CY(0))-(CX(1),C
Y(1)),PSET
2050 HLINE-(CX(2),CY(2)),PSET:HL
INE-(CX(3),CY(3)),PSET
2060 HLINE-(CX(0),CY(0)),PSET
2070 NEXTZ
2080 HCOLOR13:HPRINT(16,11),"THE
 END"
2090 I$=INKEY$:PALETTE13,RND(48)
+15:IFI$=""THEN2090
2100 HSCREEN0:POKE65496,0:RGB:CL
S
2110 END
```

press ENTER to allow the computer to check your picks against what it has chosen. The results are then displayed on the second board opposite your picks. A black peg signifies that one of your picks is the correct color and in the right spot. A white peg indicates one of your pegs is the right color but not in the right spot. If nothing appears, all your picks are wrong colors. Then the cursor moves down one level and you get to pick again. You have 10 chances to work out the correct color sequence. It takes much patience and logic to figure out the correct sequence in only a few moves. If you figure it out or don't make it in 10 moves, the computer shows its hidden colors and asks you to play again.

When you are playing with only four pegs (levels 1 to 4), the last two pegs on all the columns are colored in black and your cursor won't move there.

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Tools of the Trade

by Tony DiStefano
Contributing Editor

When I got my first CoCo, I took it apart to learn more about it. I also bought the service manual from Radio Shack and studied it from cover to cover. After playing around with the CoCo for a while, I managed to burn out some parts and had to get it fixed at a Radio Shack repair shop. That was the first time I had to do that, but it was not the last. I continued to burn out computers, power supplies, circuits and so on. But, I didn't give up. I tried and tried again, learning from my mistakes. Eventually I learned how to trouble-shoot my own projects as well as those of other CoCo users.

I received a phone call the other day from someone having problems with a project. I noted that even though he had experience with electronics, he needed better trouble-shooting skills. The need for these skills is common among many of those who call me for help. Therefore, I think it's important to discuss in detail the tools and techniques needed for effective trouble-shooting.

The most important part of trouble-shooting is your set of tools. You need a set of screwdrivers; two or three sizes of pliers, including a thin pair of long-nose pliers; and two pair of cutters, including a big one for cutting everything and a small straight-edge one for electronic component cutting. You also need wire strippers and a good X-Acto knife. Depending on the kind of work you are doing, a small portable vise might be good to have. I also have a drill, hammer (to smash things when I get real upset), soldering iron, solder sucker and wick.

That is only half the list. Those tools are used to get to circuits; you need a set of tools for the actual circuit testing as well.

The first tool you need for circuit testing is a general-purpose VOM (Volt/Ohm Meter). The necessary options are volts, ohms, current, continuity (the most important part of a meter) with an audible indicator and a diode check function. When you buy a new meter, check the continuity scale by turning the meter to that scale and making a simple test. It is important to short out the leads and check the delay time before the beep starts. The longer it takes for the sound to come on, the slower the process will be when you are looking for an open circuit. In trouble-shooting, you must touch the suspect connection, then wait; as soon as you hear the beep, go on to the next one. This is no big deal if you have only a few pins. But if you have 100 pins to check, the delay time is important. The converse is also true; if you are looking for a short circuit and go too fast, the beep does not go on and you miss it.

Now let's discuss the diode checker, which sometimes comes with the continuity checker. The continuity scale is really a low-ohms scale. If the circuit being tested is less than about 500 ohms, the beep sounds continuously; if the circuit is between 500 and 1000 ohms, it gives a short beep; if it is over 1000 ohms, it is quiet. The short beep means there is a diode junction between the leads of your meter.

The VOM is good for most general testing and is great in analog circuits. But for digital logic it is less useful because things happen too fast for the meter to react. Take, for instance, the E clock of the CoCo's CPU. Check it and make sure the signal is there. When the signal is low, it is about 0 volts; when the signal is high, it is about 5 volts. In this case, however, the E clock is changing from one state to the other at a rate of a million times per second. For a VOM, this is too fast, even on the AC scale. The VOM measures about 2 volts, which is the average voltage. To you, this reading is useless. Two volts can mean anything — the circuit is dead and there are 2 volts of leakage, or it's working fine.

Let's say you are checking a memory-mapped latch that does not work well. Using a BASIC program, you store a value in that latch. The program does this only once. The cycle time that the CoCo's CPU takes to write to a latch is about 500ns. There is no way a regular VOM can measure that, so you need a different type of test meter.

This other test meter is called a logic probe, which is made just for testing digital signals. It's a necessity for digital work and a perfect tool for trouble-shooting my projects; and it sells for under $30. The probe must be powered, so it comes with clips; it requires 5 volts and ground. (It's not hard to find this power on a CoCo.) A logic probe has 3 LEDs; one indicates a Low, the other indicates a High. A third LED indicates whether a pulse or signal is present. It is perfect for checking the CoCo's E clock. Just put the probe's test point on the pin and one or more LEDs light up. If the signal in question is Low, then the low LED lights up; if it's High, the High LED lights up. If there is a signal present, the Pulse LED lights up; if the signal is high-frequency, both the Low and High LEDs light up in proportion to the duty cycle of the signal. If the signal is mostly Low and a short pulse High, the Low LED is bright and the High LED is dim and vice versa.

Tony DiStefano is a well-known early specialist in computer hardware projects. He lives in Laval Ouest, Quebec. Tony's username on Delphi is DISTO.

Another function the probe can perform is that of memory. Setting the Mode switch from Pulse to Memory causes the Pulse LED to stay off until there is a change of state on the input lead; when a change is detected, the Pulse LED goes on and stays on until the Mode switch is reset. This is a very handy option.

Earlier I mentioned a BASIC program that stores a value into memory. The pulse is so quick that a VOM cannot catch it but a logic probe does not miss it. Put the probe on the pin in question and set the switch to Memory. Run the program. If the pulse comes through, the Pulse LED comes on and stays on, which is proof that the pulse got as far as that point. I have an old-model logic probe; the newer ones feature audible indications. No sound means no signal. A low-pitch sound means the signal is Low. A high-pitch sound means the signal is High. Sounds in between mean a high-frequency signal is present.

The VOM and the logic probe are both relatively inexpensive and are a must if you want to do any type of trouble-shooting or project-building. You simply cannot do without them, especially if you encounter problems and the project does not work the first time. There are, however, more tools than this. Two more important pieces of test equipment are the oscilloscope and the logic analyzer.

The oscilloscope, or scope for short, is a very powerful piece of test equipment. Oscilloscopes are used to show you how a voltage varies with respect to time. A typical scope has two voltage inputs and a small display screen. This display, which usually measures 5 inches square, has a series of horizontal and vertical lines — a grid — inscribed on its face. There are also several controls to allow you to change how the scope presents its measurements. In simple terms the display screen, your main output, lets you see what is happening at the inputs. Most everyone has seen a heart monitor at some time or another. (It goes beep-beep-beep or be-e-e-e-ep when you lose the patient.) A scope is similar.

The electron gun in the display tube produces a single dot on the screen. This dot moves from left to right across the screen, disappears for a fraction of a second, then reappears on the left. This occurs over and over very quickly. The speed at which the dot moves is controlled by one set of controls called the *horizontal sweep control*. The scale of movement is measured in *time per division*, a division (sometimes referred to as a *graticule*) being one section of the grid drawn on the screen. A typical scope allows horizontal sweep speeds from 0 (stopped) to .2 microseconds per division. When the dot traces across the screen fast enough, it forms a straight line much as a TV screen does.

The input voltage to a scope controls the vertical trace — vertical displacement —

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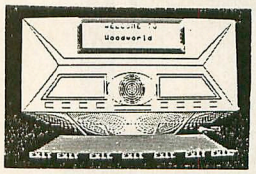

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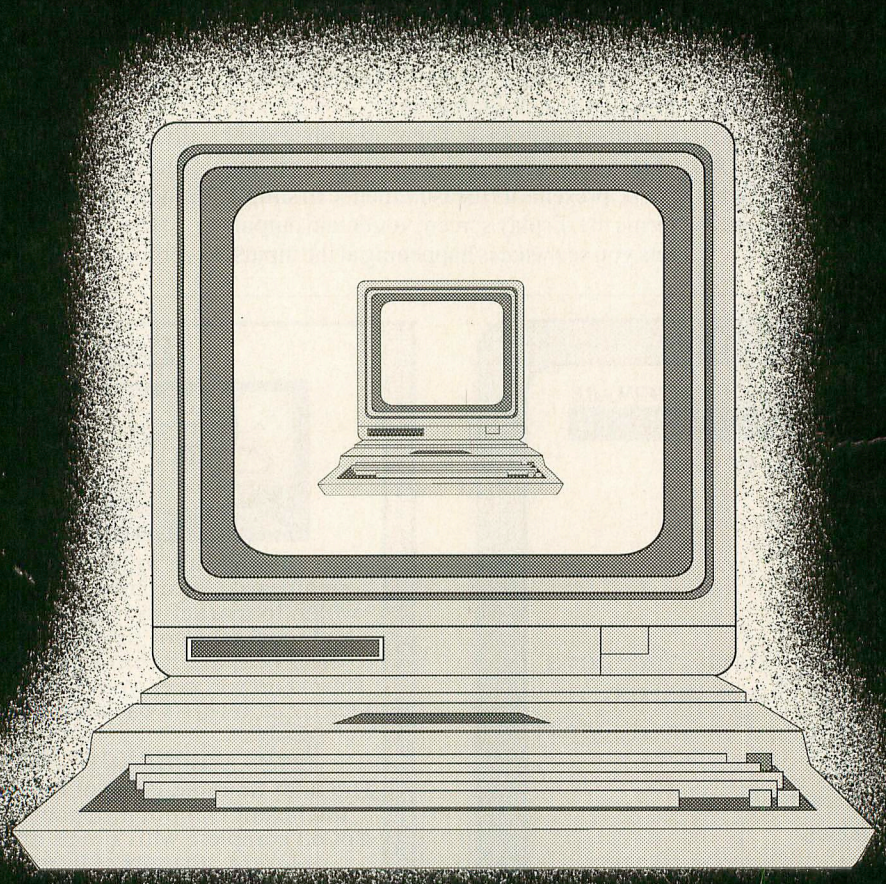
Your CoCo is the longest-lived, most innovative and, surely, best-loved Computer ever to hit the market. In constant use by millions of us for a decade now, its story is both an interesting and fascinating one. And now you can relive it all — all the fun, the people, the frustrations — in *CoCo: An Affectionate History of the Tandy Color Computer*.

This anecdotal history of the CoCo, by well-known authors Dale and Esther Puckett, tells the stories of those people at Tandy who brought us the Color Computer; the programmers who've put the 6809 through its paces; the hardware gurus with their electronic marvels; and the many vendors who have made these innovations available to us. You'll also read about people like you who have supported the Color Computer with countless hours at the keyboard and by attending CoCo functions. You never know — you might even read about yourself. And this says nothing of the many pictures you'll see.

CoCo: An Affectionate History is scheduled for release early in the fall of 1990. Prior to publication it will be available in an attractive limited-edition hardcover version for only $45. A softcover version will also be available for $15.95. But if you order now, you can reserve copies of the softcover version for a pre-publication price of just $13.50 apiece. Reserve a copy of *CoCo: An Affectionate History* for yourself. Or order several for those you care about — and take a walk down Memory Lane together.



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moving the dot up and down. Another set of knobs controls the scale for this movement, which is measured in *volts per division*. An average scope has a range of .2 mV (millivolts) to 10 volts per division.

For a DC voltage such as that produced by a battery, a simple VOM gives accurate measurements. But for a varying signal you need a scope to see the exact wave shape. Let's look at an example.

Hook a battery and potentiometer in series to a voltage meter. If you turn the pot, the voltage on the meter changes. If you start to run the pot up and down quickly, the meter's needle moves up and down also. But if you start to move the pot faster and faster, the needle does not keep up. In fact, at about 20Hz it starts to give you false readings. If you connect this pot to the input of a scope, you'll have no problems seeing the voltage change. The dot moves up and down according to the amount of voltage seen by the input to the scope and the scale to which the vertical input is set. If the horizontal trace scale is set to 0 as you turn the pot, the dot on the screen moves up and down. When you set the horizontal trace to start moving the dot across, you see a wave shape.

This is basically what a scope does; it shows you the wave shape of the incoming signal. In order to see a wave shape that changes very fast, you must select a faster horizontal sweep setting.

There are many more adjustments on a scope. One is to synchronize the incoming signal to the horizontal trace so the picture is stable on the screen. Some scopes allow dual time bases and dual traces. There are many more options available, but I think you get the idea. Though a scope is an ideal piece of hardware for electronics work, it is very expensive. Prices start at about $500. It is a necessary tool for me because I design hardware. But it is a luxury for most project builders.

The VOM and the logic probe are both relatively inexpensive and are a must if you want to do any type of trouble-shooting or project-building.

The logic analyzer is sort of a cross between a logic probe and a scope, and it works only with digital signals. It works like a scope in the sense that it has a screen and a horizontal sweep section. But the vertical trace is digital only, and a logic analyzer has many inputs. The one I have has 32 inputs.

This logic analyzer can be described as a big 32-bit-wide memory chip with a screen. When you trigger, or start, the analyzer, it records all the signals in memory at a predetermined sample rate. Then when the memory is full, you can scan its contents via the screen display. You can scan for certain patterns. It is even possible to have the analyzer scan the incoming signals and wait for a particular pattern before it starts storing the signals in memory. This tool is handy when you have a complex digital circuit and want to know if it works like it should. It is also handy when you want to see a certain timing sequence that does not happen regularly — for example, when you want to see what happens when the CPU reads or writes to a specific memory location. This tool is necessary only in certain instances and is generally not used in trouble-shooting but in hardware and software development.

Those are my tools. Next time I'll show you some trouble-shooting techniques.

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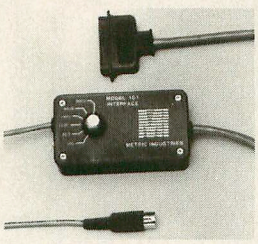

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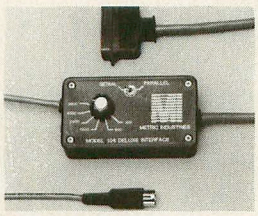
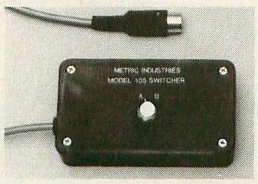
Serial to Parallel Printer Interface

★ Works with any COCO
★ Compatible with "Centronics" Parallel Input Printers
★ Just turn the knob to select any one of 6 baud rates 300-9600
★ Comes complete with cables to connect to your printer and computer
★ Can be powered by most printers



Model 104 Deluxe Interface with "Modem Switch"

★ **Same Features as 101 Plus**
★ Built in Serial Port for your Modem or other serial device
★ Switch between Serial Output and Parallel Output
★ Comes with cables to connect to your computer and printer
★ Can be powered by most printers



Model 105 Serial Switch

★ Connects to your COCO to give you 2 switch selectable Serial Ports
★ Comes with a 3 foot cable to connect to your computer
★ Now you can connect your Printer (or printer interface) and your Modem (or other serial device) to your COCO and flip the switch to use either device
★ Does not require power

Cassette Label Printing Program

★ **New Version 2.1 prints 7 lines** of information on Cassette labels
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★ Uses the features of your printer to print standard, expanded, and condensed characters
★ **Automatically Centers Each Line of Text**
★ Allows editing of label before printing
★ Program comes with 24 labels to get you started
★ 16K ECB required

Some of the Printers That Can –
Supply power for the 101 and 104 are Radio Shack, Star, Okidata, Brother, Juki, and Smith Corona.

Some of the Printers That Cannot –
Supply power for the interfaces are Epson, Seikosha, Panasonic, Silver Reed and NEC. If your printer cannot supply power to the interface you can order your interface with the "P" option or you can supply your own AC adapter. We recommend the Radio Shack 273-1431 AC adapter with a 274-328 connector adapter.

Write or call for more information or for technical assistance.

Price List

Model 101	**35.95**
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Model 104P	51.95
Model 105	14.95
Cassette Label Program	6.95
Pin Feed Cassette Labels:	
White	3.00/100

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The next best thing to a word processor

CoCo Typer

by Robert Allen Turner

I have been programming with a Tandy CoCo since Santa brought me one in December of 1983. Over the years I've written many programs — some I thought were good enough to be submitted to THE RAINBOW. The magazine requires that articles be submitted in ASCII format, which is readable by all CoCo word processors. This presented a problem because I do not have a word processor. I looked into purchasing one but they were out of my price range. Therefore I created *Colortype*, a typewriter program for the CoCo.

Colortype simulates an electronic typewriter and allows for setting margins, line spacing and cassette and disk saves in ASCII format. It is simple and easy to use.

The program is set up to run at the default

Robert Turner works full time and is a student at R.E.T. Electronics Institute. He and his wife, Tracy Anne, have a son, John Eric. He may be contacted at Rt. 5, Box 2806, Pell City, AL 35125.

printer baud rate. If you want to change it, be sure to do so before loading the program. To load the program, type RUN"COLRTYPE" and press ENTER. The first prompt asks if you want to load or print an old file. At this point, press N for No. Next, set your margins and spacing by responding to the prompts. The program then proceeds to ask you whether you want to save to tape or disk. After responding *Colortype* requires you to name the file using eight characters and a three-character extension. At this point, if you want to save the file to another disk, insert that disk in Drive 0 and press ENTER.

Now you are ready to begin typing. The letters you type are all uppercase. To make them lowercase, press SHIFT-0. Now you can just press SHIFT and a letter to make that letter uppercase.

Type until you hear a bleeping noise. When you hear it, stop typing and back up to the space before the last word you typed. Then press ENTER and the printer will print that line. Continue in this manner throughout your document. After you have created and printed the entire file one line at a time and saved it to disk, you can then run the program and print it out completely in one fell swoop.

Though *Colortype* cannot replace a good word processor, it makes a dandy submission writer and is also good for general-purpose typing. All files created with this program should be compatible with most word processors, so if you upgrade to a word processor later, you will be able to use your *Colortype* files. Before you invest a bundle in an expensive word processor, give *Colortype* a try and see if it meets your needs. ❑

Though *Colortype* cannot replace a good word processor, it makes a dandy submission writer and is also good for general-purpose typing.

16K Extended

```
70 ..... 49
100 ..... 94
130 ..... 184
150 ..... 68
240 ..... 203
280 ..... 183
350 ..... 120
390 ..... 50
420 ..... 221
END ..... 157
```

The Listing: COLRTYPE

```
0 ' COPYRIGHT 1990 FALSOFT, INC
10 CLEAR 1000 'COLRTYPE V:1
20 CLS:PRINT@ 104,"COLOR TYPEWRI
TER"
30 PRINT@ 166,"ROBERT ALLEN TURN
ER":PRINT@ 231,"(C) 25 APRIL 198
9"
40 PRINT:PRINT:PRINT "LOAD & PRI
NT OLD FILE (Y/N)?"
50 A$=INKEY$:IF A$="Y" THEN 350
ELSE IF A$<>"N" THEN 50
60 PRINT@ 256,STRING$(32,"-");:P
RINT "SET MARGINS (0-132):"
70 PRINT @320,STRING$(30,32);:PR
INT @320,;
80 LINEINPUT "LEFT->";L$:L=VAL(
L$):IF L<0 OR L>132 THEN SOUND 1
```


*** EXTENDED * ADOS-3**

*** Built-in RAMdisk * Point-and-pick file select menu ***

Not a new version of ADOS-3, but a new product that shares space with ADOS-3 in a 16K EPROM. Arrow-key selection of files to execute, LOAD, COPY, KILL or SCAN. The BACKUP command is doubled in speed for full disks, proportionately faster for partly full disks. (BACKUPs to or from the RAMdisk typically take 5 to 20 sec.) • BACKUP-with-format • Wild-card COPY and KILL, with optional prompting for individual files • Date (or date/time with hardware clock) displayed for files in the directory, printed on LLISTings • DATE$ function • Key repeat • Block move/copy of BASIC program lines • Text screen printer dump • Auto-reboot of a BASIC program or the DOS command • Parallel printing • Read/write/format 35/40 tracks on 80-track drives • Supports 3 double-sided drives plus 2 RAMdrives • Allows different numbers of tracks on different drives • Shares the original's excellent compatibility with commercial software. For 128K CoCo 3 with ADOS-3 (RAMdisk use requires 512K). Includes information on having an EPROM burned (cost is $15) after configuring Extended ADOS-3. Disk, **$39.95.** Extended ADOS-3 plus ADOS-3, **$64.95.** Driver for Disto real-time clock, **$5.** Adapter for controllers lacking 28-pin socket, **$10.** SmartWatch real-time clock (Tandy 25-1033 equiv.), **$35** (Drivers for Ext. ADOS-3 and OS-9 included; usable in 28-pin socketed controllers or in Rompack, **$10).**

"...will blow your socks off...impossible to give Extended ADOS-3 anything other than a rave review."
— Rainbow, October 1989.

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— CoCo Clipboard, Sept/Oct 1989.

ADOS-3 (reviewed July 1987)
Customize default startup message, colors, screen width, baud rate, step rates, processor speed, number of tracks (35, 40, or 80). Disk I/O and printing are reliable at double CPU speed. Extra commands such as FAST, SLOW, AUTO, RUNM, SCAN, CAT, PRT ON/OFF. Keystroke macros, arrow-key scroll through BASIC programs, edit/repeat of last command, auto-edit of error line, ML monitor, lots more. Usable as a disk utility or in EPROM. 128K Coco 3. EPROM-burning (cost is $15-20) information provided. Disk, **$34.95.** **ADOS** for CoCo 1 and 2 Disk, **$27.95.**

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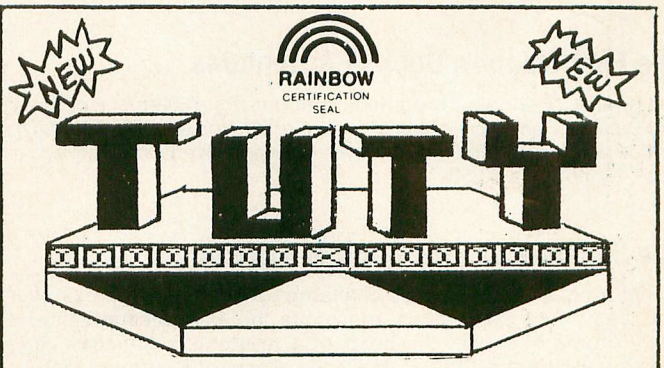

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```
50,1:PRINT "ILLEGAL! 0-132":GOTO
 80
90 LINEINPUT "RIGHT->";R$:R=VAL(
R$):IF R<0 OR R>132 THEN SOUND 1
50,1:PRINT "ILLEGAL! 0-132":GOTO
 90
100 LINE INPUT "SPACING (1-3) 1=
NORMAL, 2=DOUBLE3=TRIPLE->";S$
:S=VAL(S$):IF S<1 OR S>3 THEN SO
UND 150,1:PRINT "ILLEGAL: 1-3":G
OTO 100
110 PRINT STRING$(32,"-"):PRINT
"SAVE <T>APE <D>ISK <N>O SAVE"
120 A$=INKEY$:IF A$=""THEN 120 E
LSE IF A$="D" THEN X=1 ELSE IF A
$="C" THEN X=-1 ELSE IF A$="N" T
HEN X=0 ELSE 120
130 SOUND 150,1:IF X<>0 THEN LIN
EINPUT "FILENAME (8 CHARACTERS)-
---->";F$:F=LEN(F$):IF (F<1)+
(F>8) THEN PRINT "ILLEGAL!":GOTO
 130
140 IF X=1 THEN LINEINPUT "ENTER
 EXTENSION (3 CHARACTERS)->";X$:
IF LEN(X$)>3 THEN SOUND 150,1:PR
INT "3 CHARACTERS MAX.!":GOTO 14
0 ELSE F$=F$+"."+X$
150 CLS:IF X=-1 THEN PRINT "PREP
ARE CASSETTE PLAYER IN      RECO
RD MODE" ELSE IF X=1 THEN PRINT
"INSERT TARGET DISK IN DRIVE:0"
160 SOUND 150,1:INPUT "PRESS [EN
TER] WHEN READY:";A$
170 IF X<>0 THEN OPEN "O",X,F$
180 SOUND 150,1:CLS:A=R-L
190 PRINTCHR$(128);
200 B=0:C=1:T$=STRING$(132,32)
210 IF C<1 THEN C=1
220 C$=INKEY$:IF C$=""THEN 220 E
LSE IF C$=CHR$(12) GOTO 300
230 IFC=1THENPRINTCHR$(8);" ";
240 IF C$=CHR$(8) THEN PRINT C$;
C$;" ";C$;CHR$(128);:C=C-1:IF C<
1 THEN C=1:SOUND 150,1:ELSEMID$(
T$,C,1)=CHR$(32):GOTO 210
250 IF C=A THEN SOUND 150,1:SOUN
D 200,1:SOUND 150,1:B=1
260 IF B=1 THEN IF C$=CHR$(32) T
HEN C$=CHR$(13)
270 PRINTCHR$(8);:MID$(T$,C,1)=C
$:C=C+1:PRINT C$;CHR$(128);:IF C
$=CHR$(8) THEN MID$(T$,C-1,1)="
"
280 IF C$=CHR$(13) AND X><0 THEN
 PRINT #X,MID$(T$,1,C-1);
290 IF C$=CHR$(13) GOSUB 320:GOT
O 200 ELSE 210
300 IF X><0 THEN CLOSE #X:PRINT:
PRINT "DATA SAVED. YOU MAY REMOV
E MEDIA"
310 PRINT #-2,CHR$(13);:END
320 PRINT #-2,TAB(L);MID$(T$,1,C
-1);
330 IF S>1 THEN PRINT #-2,"":IF
S>2 THEN PRINT #-2,""
340 RETURN
350 LINEINPUT "ENTER LEFT MARGIN
 (0-132)";L$:L=VAL(L$):IF L<0 OR
 L>132 THEN PRINT "ILLEGAL!":SOU
ND 150,1:GOTO 350
360 PRINT "SPACING (1,2,3)"
370 A$=INKEY$:IF A$=""THEN 370 E
LSE A=VAL(A$):IF A<1 OR A>3 THEN
 370
380 CLS:PRINT "<T>APE <D>ISK OR
<E>XIT"
390 A$=INKEY$:IF A$="" THEN 390
ELSE IF A$="D" THEN X=1 ELSE IF
A$="T" THEN X=-1 ELSE IF A$="E"
THEN CLS:PRINT "BYE." ELSE SOUND
 150,1:GOTO 390
400 LINEINPUT "FILENAME (8 CHARA
CTERS)---->";F$:IF LEN(F$)>8
 OR LEN(F$)<1 THEN SOUND 150,1:P
RINT "ILLEGAL!":GOTO 400
410 IF X=1 THEN LINEINPUT "ENTER
 EXTENSION (3 CHARACTERS)->";X$:
IF LEN(X$)>3 THEN PRINT "ILLEGAL
! MAX. 3 CHARACTERS!":GOTO 410 E
LSE F$=F$+"."+X$
420 IF X=1 THEN A$="DISK" ELSE A
$="TAPE"
430 PRINT "INSERT "A$" CONTAININ
G FILE-->"F$
440 INPUT "PRESS [ENTER]";A$
450 OPEN "I",X,F$
460 LINEINPUT #X,C$
470 PRINT #-2,TAB(L);C$:IF A>1 T
HEN PRINT #-2,"":IF A>2 THEN PRI
NT #-2,""
480 IF EOF(X)=-1 THEN 500 ELSE I
F INKEY$=CHR$(12) THEN 500
490 GOTO 460
500 CLOSE #1:PRINT "**DONE**":EN
D
```


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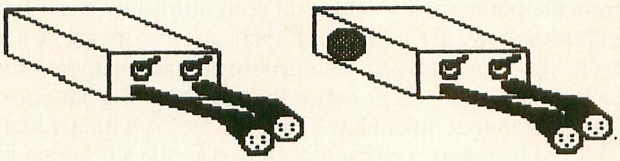

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OS-9 vs. BASIC

by Marty Goodman.
Contributing Editor

What is the advantage of using OS-9 as opposed to BASIC? Is OS-9 a different programming language?

Tim Arview
West Frankfort, Illinois

OS-9 is not a programming language. It is an entirely different operating system — a framework within which other languages and programs can operate. Your confusion may stem from the fact that Disk Extended Color BASIC (DECB) found in the CoCo at power up is both a BASIC language and a very rudimentary operating system, all rolled into one. OS-9 is an operating system only — it has no built-in language.

OS-9 is more powerful and therefore vastly superior to DECB. It permits you to easily hook a multitude of hardware devices to the CoCo, works with a wide variety of floppy and hard drives and permits multitasking (running many programs at the same time).

The BASIC (BASIC09) that comes with it is a very sophisticated, powerful form of BASIC. On the other hand, an operating system is, from the point of view of an end user, ultimately as desireable or undesirable as the utility and application software that runs under it. So, if your needs are being met by the application software you have under DECB (often called RS-DOS), then you have no need for OS-9. If you are planning to use the CoCo with a variety of specialized hardware, or if you need to compile a program while playing a game or downloading a file, then you will want to use OS-9 software. Keep in mind that you may want OS-9 if you plan on programming in C or FORTRAN, because those languages are available only under OS-9.

Rampage to Disk

How can I put the ROM pack Rampage *onto disk?*

Matthew Thomas
Vancouver, Washington

Rampage consists of a 32K ROM, and special software is required to dump the data in the ROM to disk. The program was specifically written to run out of the ROM and, according to its author, aspects of its memory usage makes allowing it to run entirely in RAM difficult. Modifying this ROM pack to run in RAM takes an experienced 6809 assembly language programmer many hours and probably requires a 512K CoCo 3.

Dead Appearance

The composite video output from my CoCo 3 appears to be dead, but the RGB video and the RF video (TV) output is working. How should I fix this?

Brian McElroy
Beacon, New York

The GIME chip generates the composite video and RGB video signals. The RGB signals are buffered as follows: The H and V sync through a 74LS04 chip, and the R, G and B luminance through transistors Q5, Q6 and Q7. As the composite video leaves Pin 65 of the GIME chip, it is buffered by transistor Q3, an emittor follower. The output of that buffer goes to both the RF-modulator box and to transistor Q2, which further buffers and amplifies the video prior to sending it out to the composite video jack on the CoCo. Thus, I'd say your CoCo has a problem only in the final transistor buffer of the composite video. Components associated with that buffer include Q3, R30 (100 ohms), R72 (120 ohms), R71 (10 ohms), C53 (.033 mfd) and C54 (470mfd/16VDC electrolytic). First look for problems in the transistor or the electrolytic capacitor.

Two Disk Drives for the Price of One?

How do I hook a double-sided disk drive to my existing Drive 0? Does this mean I access both sides of a disk and in effect get two extra disk drives for the price of one?

Ralph McCormic
Keno, Oregon

My article on floppy disk drives in the April 1990 issue of THE RAINBOW (Page 22) should provide most of the answers to your question. Exactly how you hook a double-sided disk drive to an existing Drive 0 will, in part, depend upon whether you have a Tandy or some other brand Drive 0.

If the drive is a Tandy brand, you will likely need to make up a new disk drive cable or crimp on an extra connector to your existing cable. The extra connector Tandy provides usually does not support a double-sided drive due to its having some of its teeth pulled. Jumper the new drive to set it as Drive 1 and remove any terminator resistor pack in the new drive. Be sure to use *ADOS* or

---

Martin H. Goodman, M.D., a physician trained in anesthesiology, is a longtime electronics tinkerer and outspoken commentator — sort of the Howard Cosell of the CoCo world. On Delphi, Marty is the SIGop of RAINBOW's CoCo SIG and database manager of OS-9 Online. His non-computer passions include running, mountaineering and outdoor photography. Marty lives in San Pablo, California.

some other RS-DOS enhancement in order to use the other side of the disk drive or to use it under OS-9 with appropriately configured device descriptors for the drives.

Looking at Both Sides

How do I use the other side of an FD-502 drive under OS-9?
Joey Cook
Welcome, North Carolina

You need to modify the device descriptor of your floppy disk device driver software in order to reflect the fact that the drive is double-sided.

With OS-9 Level II, use the `Config` utility to create a new boot disk using the `d0_40d` and `ddd0_40d` device descriptors. Alternatively, use `ModPatch` or `Dmode` (available on Delphi) to change the number of tracks from 35 to 40 and the number of heads from 1 to 2. Use `OS9Gen` to create a new boot disk with the changes applied. Make these changes to all floppy descriptors (`/DD` and `/D0` for single drive systems and `/D1` for two drives.) See page 5-9 of the Technical Reference manual for further information.

Getting the Hard Drive Facts

Can you tell me about how hard drive systems on the Color Computer work? Where can I get information about programming the floppy disk drive controller chip on the CoCo disk controller?
Marc Gagnon
Quebec

See my article on hard drive systems in the March 1989 issue of THE RAINBOW for an extensive discussion of that subject.

CRC/Disto, located in Montreal, may prove a useful local resource for you. As for programming the floppy disk drive controller chip (the Western Digital 1793 or 1771 controller chip), I suggest two things: Call Western Digital for the data sheets for that chip, and buy *Disk Extended Color BASIC Unraveled* (available from Microcom). The latter is a commented disassembly of the BASIC disk ROM of Radio Shack BASIC. Closely study the `DSKCON` code and `FORMAT` code (read/write sector code and format entire disk code). This is found around $D500 through $D800 of the ROM disassembly. The chip is complex and has some quirks not even documented in the Western Digital literature (such as certain needed settle times it requires after receiving a command) but which are observed by the Microsoft BASIC code.

Controller-Pak Connection

Some folks use Y cables to connect a disk controller and a Speech/Sound Pak or RS-232 Pak to a Color Computer. Microcom sells such Y cables for $27.95. Can I make one for less money than it would cost if I bought parts from Radio Shack? Or should I try to buy an old Multi-Pak Interface or one of the newer Multi-Pak replacements? How important is the buffering that Multi-Paks and Multi-Pak replacements provide?
Steve Ostrom (STEVEOS)
Minnetonka, Minnesota

Microcom's Y cables are made with parts not sold at Radio Shack. The parts used in Microcom's Y cable (40-pin Kell AM

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brand, male and female, row-reversed, IDC-edge card connectors) are not commonly available from most major electronic supply houses. I don't know of a source for those connectors in quantities less than 100.

The male 40-pin, Kell AM connector is hard to crimp to a ribbon cable. Disto used to sell a male-to-male 40-pin edge-card adaptor. Standard 40-pin, edge-card connectors aren't available at Radio Shack either, but most electronics supply houses carry them and are willing to sell them in quantities of one.

I recommend using a Multi-Pak or Multi-Pak replacement. It is true that on many systems a Y cable works well. But on others, the introduction of the Y cable leads to unreliable disk I/O. The buffering that a Multi-Pak or a device such as Howard Medical's Slot Pak II or Orion's XPORT is not the only advantage. Such devices don't have the same capacitance on the address and data lines as a ribbon cable. Some of these devices also provide an extra source of +5 volts, which is not that important with the RS-232 Pak but could be critical with something like a Burke and Burke hard drive system. You could get away with using a Y cable much of the time if you have a single, low-power device like an RS-232 Pak or Speech/Sound Pak.

Auto-dial With a Smartmodem

Is an RS-232 Pak needed to auto-dial with a Hayes Smartmodem 1200? I'm using Greg-E-Term *Version 1.0 and* Mikeyterm *Version 4.7 on a stock, disk-drive-equipped CoCo 3.*

Dee Friedlander (STREETHEART)
Scotch Plains, New Jersey

Many CoCo 3 terminal programs support 1200- or even 2400-baud operation via the bit-banger port (the 4-pin socket on the back of the CoCo 3, labelled Serial I/O). With such programs and a CoCo 3, the RS-232 Pak is not really needed, and so you don't need a Y cable or Multi-Pak.

The programs that I know support 1200-baud or greater serial communication through the bit-banger port are *Greg-E-Term* Version 2.0 and *DelphiTerm* (both available in Delphi's CoCo SIG database) and *VTerm* (an excellent commerical terminal emulator that also features VT-100 emulation; available from Gimmesoft). If you are using OS-9, however, you need to get an RS-232 Pak and Y cable or Multi-Pak (preferably the latter) for telecommunications at greater than 300 baud. The structure of the operating system is such that an ACIA-driven serial port like the RS-232 Pak is absolutely required.

Your technical questions are welcomed. Please address them to CoCo Consultations, THE RAINBOW, P. O. Box 385, Prospect, KY 40059.

We reserve the right to publish only questions of general interest and to edit for brevity and clarity. Due to the large volume of mail we receive, we are unable to answer letters individually.

Questions can also be sent to Marty through the Delphi CoCo SIG. From the CoCo SIG> prompt, pick Rainbow Magazine Services. Then at the RAINBOW> prompt, type ASK (for Ask the Experts) to arrive at the EXPERTS> prompt, where you can select the "CoCo Consultations" online form, which has complete instructions.

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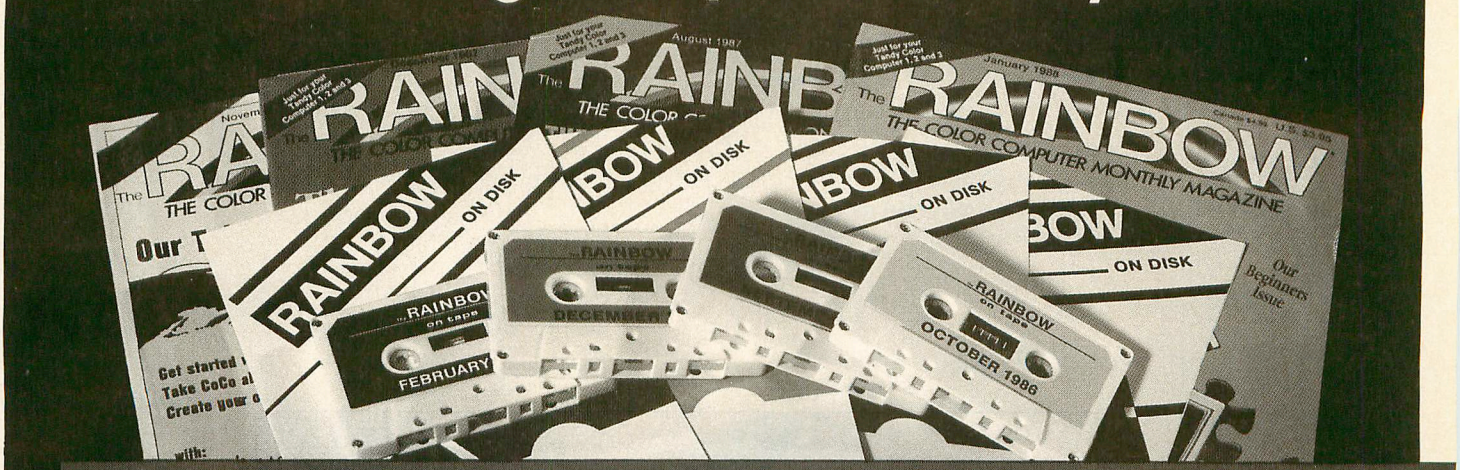

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RAINBOW ON DISK Offers OS-9 Programs

In addition to all the programs offered on tape, part of one side of RAINBOW ON DISK is formatted for the OS-9 operating system. That means you can now get all the OS-9 programs from the magazine — programs that cannot be put on tape. Back issues of RAINBOW ON DISK are available beginning with October 1986. Subscriptions to RAINBOW ON DISK are $99 a year in the U.S. Canadian rate is U.S. $115. All other countries, U.S. $130. Single copy rate is $12 in the U.S.; U.S. $14 in Canada; and U.S. $16 in all other countries.*

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Software CoCo 1, 2 & 3

Label Designer— The Final Word on Labels

My 2-year-old daughter gave me a virus just before Christmas, so I was at home (in front of the computer, natch) when my secretary telephoned to read the mail to me. My interest peaked when she said a large envelope had arrived from THE RAINBOW.

"Open it up and tell me what's inside," I said.

"They want you to review a program called *Label Designer*," she responded.

My immediate reaction was . . . gee, just what CoCo consumers need, another label-making program — six lines of PRINT commands inside a FOR/NEXT loop, right? Wrong!

When I brought the package home, the first thing I pulled from the envelope was Zebra System's 63-page owner's manual. I was impressed. It is comprehensive, easy-to-understand and is indexed and subtitled for quick referencing. It states on the cover that *Label Designer* runs on the CoCo 3 and on CoCo 1s and 2s with 64K memory. It also requires a disk drive, mouse or joystick and dot-matrix printer.

I know what you might be thinking. With a 63-page owner's manual, how hard is it to get going? You just enter RUN "LABEL". From there on out you may not need to look at the manual. I was able to print some nice-looking labels in just a few minutes.

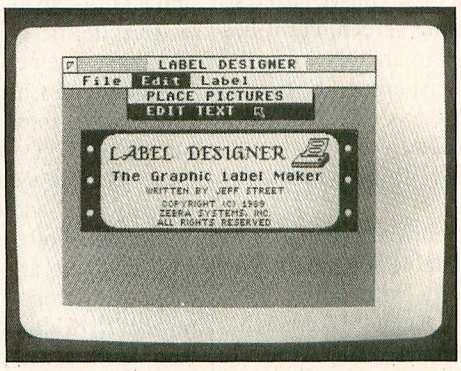
Label Designer's interface uses a point-and-click scheme. There is a menu bar at the top of the screen that lets you choose from three menus: File, Label and Edit.

The File menu contains the following items: New, Load, Save, Preview, Print, Print Merge, Setup Printer and Setup Drives. As you can imagine, there's not much guesswork involved. If you want to create a new label, click on New. If you want to save your label, click on Save. The Setup Printer feature lets you set the printer baud rate, set linefeeds and select from an extensive list of custom printer drivers for just about all Tandy, Epson, C. Itoh, Panasonic and Star dot-matrix printers.

The Label menu has five items that represent five different styles of labels you can design. There are standard address labels, large address labels, file folder labels, cassette and disk labels. You just click on the appropriate label and *Label Designer* does the rest.

The Edit menu contains only two items: Place Pictures and Edit Text. *Label Designer*'s main feature is the ability to com-

bine pictures and text on labels. It just so happened that I needed to print a number of standard-size labels for a federal tax program. Aside from the usual title and copyright, I thought it would add a nice touch to put some official-looking emblem on the label. I clicked on the Place Pictures option and a large label appeared in the middle of the screen. At the bottom are a picture window, icons and buttons. The window has a scroll bar you can use to cycle through 32 pictures that can be dragged over to the label area and clicked into place in one of any of three sizes. I found a federal-like symbol of an eagle and positioned it on the left part of the label. The final result looked very nice — infinitely better than anything I had ever done on my own.



The second of the two picture files in this program contains an additional 32 pictures. These files include the individual alphabet letters and numbers. For some odd reason, the alphabet only goes up to the letter V. Someone with a last name like mine could get offended by an omission like that. As many as four pictures can be placed on a label, and they can be placed or erased by simply dragging them on or off. They can even be overlapped for effect. The whole process is rather fun. Unlike with drawing programs, no artistic ability is required; everything is already there for you.

The Edit Text function works similarly. There is a large, blank label in the middle of the screen on which you enter text by pointing and clicking on the desired line and typing in the text. From the bottom area you can load one of three fonts and select from four styles of each font — small, tall, wide or big. All of this is done by clicking on the appropriate screen button. Each line of text can be individually centered, right or left justified. Once you've completed your creation you can print it or save it to disk. The manual indicates that *Label Designer* uses the same font and picture files as Zebra Systems' *CoCo Graphics Designer Plus* (see the May 1989 RAINBOW for a review of this program) so that additional fonts and pictures can be used.

Essential to the entire creative process is the ability to see your label prior to printing it. This is necessary because editing can only be performed on pictures *or* text — not on both at the same time. For this purpose there is a Preview option on the File menu. If you select Preview, you can see a large graphic representation of the final product. The label is so large you must use the left/right scroll bar to see it all.

Label Designer can also do some other handy things aside from mixing text and graphics. It can print serial numbers on labels, for instance. By using the pound sign (#) character, labels can be consecutively numbered. This is useful for label identification as well as making admission tickets, inventory tags and the like.

As you probably expected, *Label Designer* can merge text files in order to print designated text using a label template. Typically this is used for processing mailing lists. Another useful feature is the Directory Function. By pressing the BREAK and Q keys together, you signal *Label Designer* to read the Drive 0 disk directory and integrate it into a label that can then be viewed, edited and printed.

There are a number of other less significant features, but I wasn't able to think of anything more I could expect from a label-making program. *Label Designer* is 100-percent professional from the manual to the program itself. It even comes with a sample starter label kit that contains a varying number of each of the five basic label types. I'd recommend the program to my own father. As a matter of fact, I did.

(Zebra Systems, Inc., 121 S. Burrowes St., State College, PA 16801, 814-237-2652; $34.95 plus 3 S/H)

—Ernest F. Zore

— About the Programmer —

Label Designer was conceived and designed jointly by Zebra Systems and Jeff Street. Jeff was responsible for doing the actual coding. He has an associate's degree in business as well as specialized computer training through a technical school.

Jeff recalls that his first real computer project was prepared for the now-defunct Timex Sinclair computer. Through a computer club meeting, Jeff met the owners of Zebra Systems and was encouraged to produce software for the CoCo.

Jeff's most notable effort thus far, again through Zebra Systems, is *Coco Graphics Designer Plus*, which is a graphics program capable of producing banners, greeting cards, signs, etc. (See the May 1989 RAINBOW for a review.) *CoCo Graphics Designer Plus* was written with a special graphics interface that permits the user to operate the program in a point-and-click style. Jeff indicated that this same easy-to-use interface was implemented in the original creation of the *Label Designer* program.

With the plethora of programs available both in back issues of THE RAINBOW and from third-party vendors, why would this area even interest him? Jeff responded by saying that *Label Designer* was a product of need rather than an effort to fill a specific software void in the CoCo market. He believed other label-making programs were very primitive, for the most part. Jeff said *Label Designer* was written in 100-percent machine language and comes equipped with printer drivers for the most common dot-matrix printers. He added that *Label Designer* works best with Tandy's DMP-105 and DMP-106.

What's next for Jeff? Well, one thing he is presently working on is a professional-looking certificate maker that would, of course, also use the slick graphics interface found in *Coco Graphics Designer Plus* and the *Label Designer*.

Software 64K CoCo 2 & 3

Riddle of the Ring— A Quest to Rescue Thy Lady Love

You thought it could never happen to you — things were going along peachy keen, the wedding was set, your love for each other made you inseparable, and then your fiancee got kidnapped by that loathsome villain, Count Kraven.

Of course he's carried her away to some uncharted mythical world you've never

heard of and locked her behind a massive door with not one but *nine* locks on it. During this text Adventure you journey through 280 different rooms in search of this door. Even after you find the door, and you will, you must solve the *Riddle of the Ring*. And you thought these things only happened to other people.

Briefly shocked, but undaunted, you waste not a moment in fleeing to save her, forgetting your sword, shield, helmet and other important accessories — perhaps you're just the epitome of sheer bravery.

Alone in the woods you stumble upon a small, abandoned cottage where you confiscate what few objects lie within it in hopes that along the way you'll meet a neighborly person who'll barter with you, for weapons — you're brave, not foolish.

You soon find that friendly neighbors are rare in this neck of the woods, but the likes of gorgons, hydras, imps, genies and frost giants are in unanticipated abundance. In fact, during your encounters with some pretty grossly inhuman beasts and an occasional beastly human, you may even forget at times the lily-white love behind your purpose while desperately trying to save your own brave neck.

That's not to say you don't love her or you're not thinking about her — you're brave and sensitive — it's just that you're not accustomed to big, hungry, nine-headed dogs and unconversational trolls. Your heart's inflamed with passion for her, but there's a fire-eating dragon whose got a passion for eating more than fire, and it's breathing down your throat. Better start using your head.

This concept of using your head dawns on you after being devoured and declared officially dead possibly several times since sitting down to play the text adventure *Riddle of the Ring* from Eversoft. This game, based primarily on Greek, Roman and Norse mythology, challenges you to remember Miss Spear's 9th-grade week-long lecture on the subject — the week she wanted you to dress up in a toga with a wreath on your head, while you spent most of the class worrying about the zit on your nose and laughing at Jimmy Hoffler's plaid pants under the flowered bedsheet he wore.

If you want clues, look up some of these familiar and unfamiliar creatures in a dictionary. The more ambitious or frustrated you become (depending on how long you've been playing), the more apt you may be to check out a book on mythology at the public library. Some background information may reveal an anecdote for slaying or outwitting these gruesome legendary figures you encounter during this journey, so you can then be on your way to save the young lady in distress. After tracking over and around rugged mountains, through slimy bogs, across scorpion-infested barren deserts and through dark, damp caves, you'll be no sight for sore eyes, but you'll have a somewhat broader knowledge of mythology.

Riddle of the Ring's text descriptions are vivid and the program moves along at an entertaining pace. The challenge of solving each encounter and ultimately the riddle of unlocking the door with nine locks is intriguing, though frustrating at times.

Riddle of the Ring runs in 32 columns for the CoCo 2 and 3. One disk drive is required. The documentation is clear and concise. The $10 price is reasonable — I've played the game every day, all day long, for a week and have progressed enough to be satisfied (but not enough to claim being a victorious hero yet!).

(Eversoft Games Ltd., P.O. Box 3354, Arlington, WA 98223, 206-653-5263; $10 plus $2 S/H)

—Kelly Goff

Software CoCo 1, 2 & 3

Lyra >>TRAX<<— A New Source for *Lyra* Files

If you're a *Lyra* user who has worked more than a few hours transcribing favorite tunes into *Lyra*'s music editor, or if your mouse has rolled enough miles to take you to the moon and back, or if you've gazed so long at the *Lyra* editing screen that it has branded its image permanently onto the backs of your eyes, then perhaps it's time to remove your transcriber's cap, rest those weary eyes and consider *Lyra >>TRAX<<*, a new source for ready-to-play music for the *Lyra* editor.

Lyra >>TRAX<< currently consists of three disks, each available separately, and each filled to capacity with music transcribed specifically for Rulaford Research's *Lyra* MIDI music editor. *Lyra >>TRAX<<* is not associated with Rulaford Research, so in order to play *Lyra >>TRAX<<*'s music files you will need the *Lyra* MIDI music editor or one of the play-only "jukebox" programs such as *Lyra BOX*, also available from Rulaford Research. Hardware requirements are the same as for the *Lyra* editor itself: a CoCo 1, 2 or 3 with a minimum 64K, a disk drive, a monitor or television, a mouse or joystick, a MIDI cable and a MIDI-capable sound synthesizer such as the Casio CT-640.

My three *Lyra >>TRAX<<* disks came with a page of documentation that included song listings for each of the three disks. Disk 1 is a collection of gospel tunes with such titles as "Onward, Christian Soldiers," "Psalm 51" and "Morning Has Broken." Disk 2, titled "Pop & Rock," includes 20 selections from several different artists, with John Denver and The Doors most heavily represented. Disk 3 is a Christmas collection with all the traditional favorites. Included in the documentation is an invitation for other *Lyra* users to submit their own *Lyra* transcriptions to the makers of *Lyra >>TRAX<<* for possible distribution in future disks. Compensation is offered in the form of a royalty percentage for each disk sold.

All of the *Lyra >>TRAX<<* files have been configured for the three-channel polyphonic Casio CT-640 or MT-240 synthesizers. If you have one of these synths, all you need to do is load a *Lyra >>TRAX<<* song file into the *Lyra* editor and play it. You will hear the songs performed with the selected instrument sounds that the *Lyra >>TRAX<<* transcribers intended. If you don't have the *Lyra* editor, you can still play the files — albeit with no editing control — through a MIDI synthesizer (with a compatible MIDI cable) by using one of the play-only programs such as *Lyra BOX*, which comes with *The Lyra Lybrary* from Rulaford Research. *Lyra BOX* also allows you to play the *Lyra >>TRAX<<* files through the monitor speaker (with very limited sound quality), as will some earlier versions of *Lyra*. But to take fullest possible advantage of these songs, you will want the latest version of the *Lyra* editor and a MIDI-capable sound synthesizer.

Despite the fact that *Lyra >>TRAX<<* files have been configured for the affordable low-end Casio CT-640 and MT-240 synthesizers, each song has been transcribed into six to eight voices to take advantage of more capable synthesizers, though occasionally the additional music lines are doublings of other lines. Instrument tables and channels are configured and instrument and tempo indicators are used, but none of *Lyra*'s more exotic (and potentially troublesome) features such as MIDI Event and MIDI Byte Codes are used.

The *Lyra >>TRAX<<* files do not include velocity (volume) data. This is not surprising as the CT-640 and MT-240 synthesizers do not respond to it. In my case, I found the lack of velocity data in the *Lyra >>TRAX<<* files actually helpful because it allowed me to insert my own velocity changes without having to track

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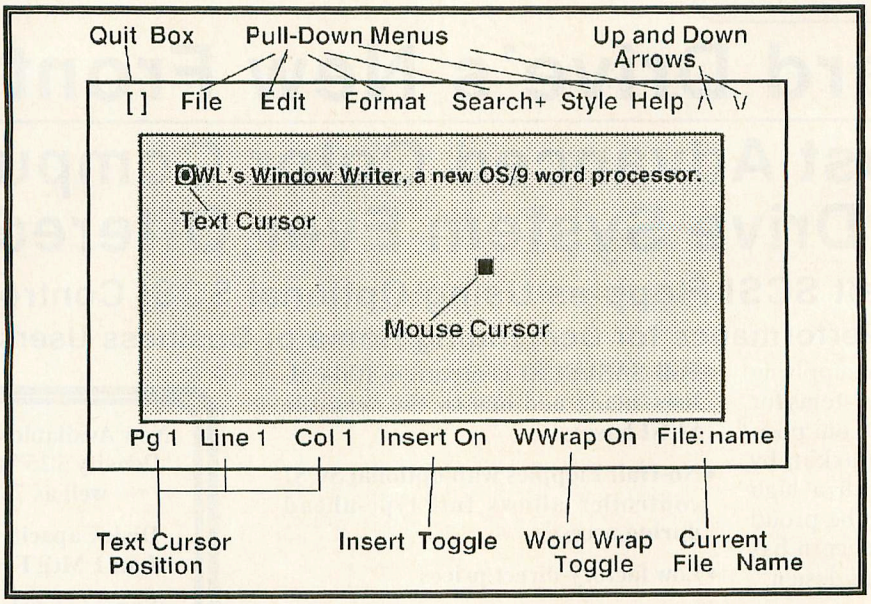
Window Writer is the first Color Computer word processor which takes full advantage of OS/9. The result is a word processor which is fully as modern and professional in action as those previously available only for the IBM and Mac. The operating system allows true multi-tasking with other programs or itself. Not limited to just printing one file and editing another. You can print one file in one window while you edit files in other windows. At the same time you can be running a small program in another window. You can cut and paste between sections of files in different windows.


Quit Box
Pull-Down Menus
Up and Down Arrows
[] File Edit Format Search+ Style Help
OWL's Window Writer, a new OS/9 word processor.
Text Cursor
Mouse Cursor
Pg 1 Line 1 Col 1 Insert On WWrap On File: name
Text Cursor Position
Insert Toggle
Word Wrap Toggle
Current File Name

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A full selection of pull down menus and detailed help screens make learning easy and are only a key stroke (or mouse click) away. All menus and help screens can be user configured for everything including menu colors and contents. You don't like the color of a menu? You think one help item should be listed differently? Change them!

The menus and help screens can be reached by cursor keys or the mouse (or joystick) or can be accessed by control keys.

Hi-Res Display

Window Writer uses an **80-column monitor display** screen for clarity. As shown in the above screen drawing, you can quickly see how to access the menus and help screens. You can determine the current position by page, line number, and column. The mouse can use this section to quickly change to a specific page or line in the file. The text insert and word wrap toggles also are indicated and changeable with the mouse button.

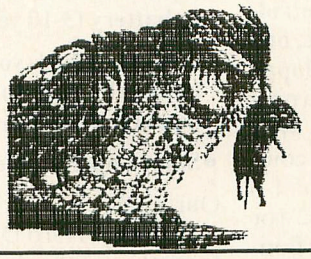
Ram Disk

A RAM disk is set up in **Window Writer** to make full use of all or a user specified portion of the memory on the 512K CoCo 3. On the 128K CoCo a smaller RAM disk is set up to still allow use of all available memory for file editing. For use of all features, a 512K machine is required.

The RAM disk is used for storage of the file(s) being edited, for the clipboard for cut and paste, and as a print spooler for the file being printed. **Window Writer's** clipboard can be saved to disk or pasted into any file being edited because files use the same clipboard memory. The RAM disk also can be used with other OS/9 programs.

Mail-Merge

With **Window Writer** you can create form letters and send them out to a list of addresses in an address file. First names or other information can be added to "personalize" these letters.



French Version:

An abridged French translation of the **Window Writer** manual is now available. This manual is written by a Canadian CoCo user and will aid French speaking users. **Only $7.50 additional.**

Editing is a snap with OWL's Efficient Mouse Usage!

Editing

Like most modern word processors, with **Window Writer** there is always more than one way to access any editing feature. You can access editing by menus using mouse, "keyboard mouse", or through control keys. Full help screens are quickly available for all editing features. A help screen can be left visible while needed and then quickly removed to get back to full screen editing.

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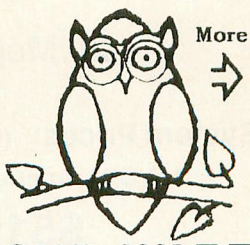

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down existing data. I liked the fact that these files do not have too many of the potentially confusing MIDI bells and whistles. I would have found it helpful if the more significant lines of music were indicated in some way. Some of the *Lyra* >>*TRAX*<< files do follow a convention of highlighting the active voices in black and the unused voices in gray, but this is not the case for all the files. I did like the fact that each file is annotated with the title of the song, the composer, the model synthesizer the file has been configured for and the name of the individual who entered the transcription.

If you have a synthesizer other than the Casio CT-640 or MT-240, you will more than likely need to use the *Lyra* editor to reconfigure the instrument tables and possibly change the MIDI channel designations for each *Lyra* >>*TRAX*<< song.This is a relatively simple process for those familiar with the *Lyra* editor. This is not due to any fault in the *Lyra* >>*TRAX*<< files; rather the problem lies with the synthesizer manufacturers. While the language of MIDI is universal, the code numbers for specific instrument sounds are not — instrument number 47 may designate a piano sound in one brand of synthesizer, while the same number may designate an entirely different sound in another brand of synthesizer.

My own synthesizer is an eight-channel, multi-timbral velocity-sensitive, polyphonic Yamaha TX81Z. Because the *Lyra* >>*TRAX*<< files are not configured for my synthesizer, I needed to change the MIDI channel settings and reconfigure the instrument tables to approximate the sounds intended by the transcribers. This also is not a definitive solution, as there is generally not a direct correspondence between instrument sounds of the same name from brand to brand of synthesizer (for example, Casio's "Celeste" sounds distinctly different from Yamaha's version).

I found that a good approach is to edit *Lyra*'s instrument table so that the same instrument sound is heard on all eight voices. A generic strings sound is a good choice. By doing this you can enjoy the songs without being suddenly distracted by a familiar sound being played at an obviously discordant register. You can then change instrument sounds a voice at a time to build more appropriate sounds for the song and your particular system. I find this opportunity to act as "musical arranger" to be one of the most rewarding aspects of working with ready-to-play files.

Overall I was impressed by the quality and thoroughness of the transcriptions. For example, I was happy to hear the complete organ solo from The Doors' "Light My Fire." I had no problem getting a good sound out of my particular system for all the songs. I wish there was a little more documentation — the single page that came with the disks was brief and contained a few spelling errors.

It is good news to hear that there is a company prepared to showcase the efforts of other CoCo *Lyra* users. *Lyra* >>*TRAX*<<'s greatest potential strength is that it seeks to draw from the creative efforts of not just a few *Lyra* users, but from the vast pool of many different talents and musical tastes. This could result in the creation of some very interesting *Lyra* >>*TRAX*<< selections.

(The CoCo Corner, 2211 University, Lincoln Park, MI 48146, 313-388-6998; $9.95 per disk)

—Walter Myers

Software

CoCo 3

RoboCop— Part Man, Part Machine, All Action

Rough day at school? You were late for biology for the third time this week, and the teacher's given you detention hall on Friday, the day you were supposed to start a new job. Upset and then bummed out, you arrive in English only to forget there's an essay test on *Billy Budd*, which you haven't even skimmed yet. It's open book but you left yours outside at recess while you sat with a sprained wrist and watched everyone else play baseball. Now it's raining.

On the bus home Lenny Beckman hit you in the back of the head with a pointy paper wad and you're about to turn around and rip his eyeballs out. In fact, you slowly turn around and lift your protractor when the bus screeches to your stop.

While calmly walking home you contemplate throwing rocks at the chained dog next door, but instead go inside, head straight to your CoCo and plug in *RoboCop*. It's what you've needed all day.

You're no longer the unluckiest person in the world but the next-to-indestructible blue metal cop who earns the respect of everyone in town, one way or another — mostly by blowing the bad guys away. The people of Detroit sing praises to your name for wiping slime off the street. You are RoboCop.

Meanwhile, you haven't had a second thought about Lenny Beckman, which is one of the redeeming values of this program, or any violent video game, for that matter — it's a way to let off steam. Of course, if the program is not entertaining, boredom may lull you into repressing some pretty intense feelings of anger. We don't want that. And neither do the makers of *RoboCop*. That's why Data East has done such a good job of making this game an exciting one.

RoboCop can punch the marbles out of yellow-haired karate kids and bald-headed brutes.

RoboCop is an expert marksman. Just press your joystick and the impact of any one of your variety of weapons, including an Auto-9, machine gun and cobra gun, sends the scumbags flying up in the air before landing flat on their backs. RoboCop can also punch the marbles out of yellow-haired karate kids and bald-headed brutes that are bigger than he is. You can hear the punches loud and clear.

It's all done in the name of justice, too. RoboCop is the good guy. Your mission is to make it past six levels of thugs, kidnappers, assassins and the powerful ED-209 robot to do your final battle with Dick Jones, the ultimate crime king. The battle gets tougher as you climb through each stage. You need to keep in mind that your bullets and energy are not unlimited and even RoboCop can endure only a limited number of hits. Each of your guns is unique and will work better against particular villains. The program allows you three attempts to make it through each stage. If you fail, it's back to stage one, which is boring sometimes but necessary because it provides you opportunity to pick up ammunition and power packs you may have missed in previous stages (as well to conserve your bullets by using fist power instead of your machine gun to wipe out the wimpy street thugs).

One drawback to *RoboCop* is that once you have made it through all six stages, there is little challenge left. You know all the right moves to make and can comfortably march through Detroit unscathed. This

weakness in the program could be remedied by Data East with the addition of more stages or perhaps an increase in the difficulty level of each stage. Little improvement, however, needs to made concerning graphics and sound, the first of which is interesting and the latter invigorating. RoboCop even thanks you for your cooperation at the end of each stage. He's just a thoughtful guy under that hard shell.

The program requires a Color Computer 3, a color TV or RGB monitor and a Tandy Deluxe two-button joystick. (You can also play using keyboard controls.)

(Data East, dist. by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX; $34.95: Available in Radio Shack stores nationwide, Cat. No. 26-3164)

—Kelly Goff

Software OS-9 Level II

Pt — File Manager— File Management Under OS-9

One of my uncles once defined the human race as having three distinct levels of intellectual capability: those who sometimes do crossword puzzles, those who often do challenging crossword puzzles, and those annoying persons who always do the *New York Times* crossword puzzle with ball-point pens. In the CoCo community, the latter category whips around in OS-9. Although both my parents always did the *Times* puzzle in pen (which is why my exasperated uncle made that remark), they raised me to also know that genius is simply *creative*, *constructive* laziness, with the emphasis on the first two words. Rick Roth's new utility *Pt — File Manager*, a point-and-shoot file-management program, is a tool of genius for those of us who don't bring ball-point pens to tough crossword puzzles.

Pt allows you to move between subdirectories and to reorganize files and directory structure.

Yes, we all know that OS-9's claim is of power and flexibility, and that its detractors abhor the time that must be spent learning and customizing a sophisticated system. I've used OS-9 since CoCo 1 days — but only for a portion of my usage because of the time needed to properly manage files! Having earned my living using directory tree structures in UNIX and on DEC/VAX mainframes, I am well aware that the only reasonable organization for computer files is an OS-9-like tree structure. And I do own *Multi-Vue*, which is supposed to provide a user-friendly environment for such structures. Also, I am a past master at the tricks of organizing the order of tasks so that CTRL-A key can save me from re-entering long pathnames. Even with all that, what I really needed (and now have) is *Pt*, which takes under two minutes to install and under half an hour to become adept at using.

The ability of *Multi-Vue* and its descendants to provide mouse control to OS-9 users — in a manner similar to that of the Macintosh — has blinded many advanced CoCoists to the advantages simpler methods may well have for the average user. I've had *Multi-Vue* since it first came out and have yet to fully implement it for lack of time and patience. Furthermore, one of the more common complaints about OS-9 is that the long pathnames make management of multiple directories and subdirectories

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frustrating. That is unfortunate, because those of us with exposure to sophisticated directory tree structures on mainframes can quickly visualize all sorts of CoCo applications for the concept. Now with *Pt*, file management in a directory tree environment can be a user-friendly activity.

Do not confuse *Pt* with *Multi-Vue*; the latter is bigger, more expensive and more elaborate. What *Pt* does is allow you to easily move between subdirectories as you reorganize both the directory tree structure and the files within it. While that sounds minor — even simplistic — it is not.

When *Pt* is called up, an overlay window appears that displays the current directory and contains a cursor (normally moved with the arrow keys). To go to a subdirectory, move the cursor to it and press ENTER. To get to the current directory's parent directory, move the cursor to the double-dot entry in the upper-left corner and press ENTER. You can also call up (in one keystroke) a menu for more complex directory tasks such as changing directories (for example, to one on a different disk drive, floppy or hard), copying directories, creating and deleting them, searching directories for a file, or displaying the directory tree structure. A similar menu for manipulating individual files is also only one keystroke away.

In the Files menu you can copy, delete, edit, move, list, hex-dump, rename and do myriad other tasks to whichever file you have highlighted with the cursor. All such operations take only one or two keystrokes. There is also a way to perform more complex commands by forming a command line and entering filenames and parameters in a wildcard manner. You can exit to the shell with one keystroke and re-enter *Pt* as easily. In short, all your file maintenance and directory manipulation chores are rapid and simple.

RAINBOW reviewers are often at a disadvantage compared to the later reader/user. We receive Version 1.0 to consider — you know, the one the testers just finished claiming finally works, but without all of the later smoothing that makes a good initial program into a great piece of software.

And sometimes the reviewer finds himself in the process of bug-chasing. In the case of *Pt*, I received Version 1.0 and (after I crashed it) Version 1.0+. Two of the major changes in Version 1.1 resulted from problems I personally encountered. Version 1.2 should be selling by the time this review appears. But along the way, I have come to not only like the program, but to have complete confidence that Rick Roth provides truly outstanding software support. He provided excellent support before he knew I was the reviewer, so I know his consistent helpfulness is what his customers can expect.

This utility should become an OS-9 classic. I do have one word of warning, however: If your experience with *Pt* does not fully match Roth's excellent documentation, consider decreasing the size of your RAM disk. *Pt* will run on a 128K CoCo 3. I used it on a 512K machine, but with such a large RAM disk that only about 24K of free memory remained. *Pt* continued to work down to when free memory approached 8K, but from about 30K down to 8K its features slowly degraded until I could crash it. I eventually crashed *Pt* enough to require a replacement copy (received in under four days at the height of the Christmas mail snarl).

Even that experience had a positive side, because it allowed me to also experience two of Roth's other products, *S — Screen Control Utility* and *M — Menuing System Utility*, which are being reviewed by others. These also work very well, are well-documented and are easy to install and use. *Pt* is designed to work alone (as are the other two), but each of the three works better if you use it with one or both of the others.

In summary, if you use OS-9, even if you already have and use *Multi-Vue*, you will find your file and directory manipulation chores much easier and even fun with *Pt — File Manager*.

(r3 Systems Consultants, 4072 E. 22nd St., Suite 178, Tucson, AZ 85711, 602-745-2327; $19.95 Disk plus $3 S/H)

—Larry Elman

Software 512K CoCo 3

Sinistaar— Save Your Galaxy

Sinistaar is a machine language arcade "shoot-'em-up in space" game written for a 512K CoCo 3 and a disk drive. In addition to the high-powered hardware, you need a joystick and either an RGB or color composite monitor in order to play this exciting new game from Sundog Systems.

The setting for *Sinistaar* is deep in the New Ursula galaxy where upon its planets live peaceful and thriving inhabitants. The peace and calm has attracted the Sinistaars, evil and powerful enemies who have begun to mine the ore-rich asteroids surrounding the New Ursula galaxy. This powerful ore is used to build large orbiting Sinistaar space stations that are capable of drawing surrounding spacecraft into their evil jaws and devouring them. The New Ursulans have discovered that the very ore used to construct *Sinistaar* ships can also be used to destroy them. Your job in this game is to pilot your ship, the *Marauder*, through the galaxy as you collect ore and convert it into *sinibombs*, which are the only things capable of destroying the evil invaders.

Sinistaar comes on two disks. One is a *flippy* in which each side of the disk contains programs. After Side 1 is loaded, you are prompted to flip the disk over so that Side 2 can load. The program self-executes after you type `LOADM "BOOT"` and press ENTER. Onscreen prompts are used, so loading is not a problem if you follow the instructions to load all three disks. The flippy idea is a good one and saves money, since the game would otherwise have to be supplied on three single-sided disks instead of just two.

Sinistar greets you with outstanding moving graphics and colorful galaxy views as the different disks are fed into the computer.

Sinistaar capitalizes on the 512K RAM capability of the CoCo 3 in both the graphics and sound departments. You are greeted with outstanding moving graphics and colorful galaxy views as the different disks are fed into the computer. One of the most amazing screens is the High Scores screen, which shows a large red Sinistaar logo over a view of the galaxy, done in different shades of blue, purple, white and black. The result is a striking 3-D effect in which the red letters stand out from the background scene.

The actual game screen is divided into four areas. The main window area is your view of the *Marauder* as you guide it through space. In the top center of the screen is a radar scanner window that shows your location relative to other objects in your current sector. To the left and right of the radar scanner are scoring windows for either one or two players. Each window displays the accumulated score, number of ships you have left (you start with three) and the number of sinibombs you have on board.

Play alternates between two players, or just one can play. In either case, only the

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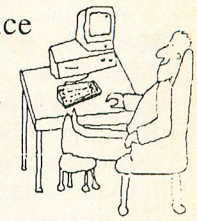

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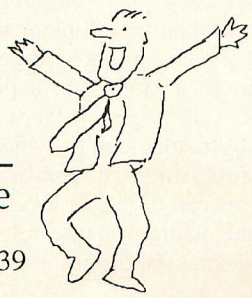

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right joystick is used. A two-button joystick makes play easier, since sinibombs can only be released by the press of the secondary joystick button — or by pressing the space bar (which means you must remove at least one hand from the joystick!). You will score more points and lose fewer ships if you don't have to press the space bar every time you want to launch a sinibomb.

The primary joystick button is used as a firebutton for shooting laser bursts. Your targets include blue enemy ships that protect the Sinistaar while it is under construction (be careful, the blue ships can shoot back), and also red drones that harvest asteroid ore and ferry it to the construction site. You'll also use your laser to fire at asteroids: This is how you mine them, in competition with the red drones, to get ore for yourself. Remember, it is the ore with which you build sinibombs.

Asteroids in various sizes and colors can be seen twisting and turning as they float through space. They are shaded just enough to give an appearance of depth and mass. By firing at them you release the ore you seek (the ore looks like spherical nuggets). If you continue to fire at them the asteroids will become unstable and explode; this is not harmful to you, however.

The ore, when freed, must be chased down. You pick up ore just by guiding your ship over it. After you first begin your mining endeavors you may be dismayed to learn that the ore you're so diligently chasing down can be plucked up by a red drone. However, you can also steal ore from the drones by shooting at them and picking up *their* ore — a *very* satisfying accomplishment after you've had numerous ore nuggets swiped from under your nose!

A Sinistaar can only be destroyed after it has been fully constructed. You can watch it being built, but be cautious since venturing too close results in being gobbled up, chewed and spit out. A Sinistaar resembles a floating skull with a lizard-like fin surrounding its red-eyed face. The Sinistaar has the ability to chase after you and will do so upon its completion. The Sinistaar chillingly announces its presence. Kudos to the Sundog people for a frighteningly effective piece of voice digitization!

Destroying the Sinistaar is not very difficult; you just release the sinibombs with the secondary joystick button or the space bar. The sinibombs automatically seek out their target; no aiming is involved. With every hit of a sinibomb, a piece of the Sinistaar is destroyed. It takes quite a few sinibombs to deal with the whole Sinistaar (and more and more sinibombs are required as you proceed to higher levels).

All the while you are releasing your sinibombs the red drones continue to harvest ore and repair or replace the missing pieces from the Sinistaar. Therefore you must continue your mining mission in order to win the battle. This is the most difficult part of the game — trying to get enough ore to convert to bombs while trying to fight off the enemy ships and other obstacles.

The destruction of the Sinistaar results in excellent graphics, color and sound effects. Program graphics and colors look outstanding on my CM-8 RGB monitor. The sound effects are the best I've heard on a CoCo 3; the explosions are especially realistic, but the most remarkable sounds are those emitted by the Sinistaar after he is constructed. His eerie speech makes you sit up and take notice. A short chord of soft string music plays when you have lost all your ships and when your score hits increments of 10,000.

I want to stress that the sound effects used in *Sinistaar* are not typical computer beeps and boops but *real-live* analog sound just as you would hear on a radio. You'll really want to turn up the sound on your monitor to hear them clearly.

Sinistaar is copy-protected, but it is guaranteed to load for one year and is priced right for a game of its caliber. I was impressed with this program and recommend it to any arcade-game fanatic who owns a 512K machine.

(Sundog Systems, 21 Edinburg Drive, Pittsburgh, PA 15235, 412-372-5674; $34.95 plus $2.50 S/H)

—Jerry Semones

Software CoCo 1, 2 & 3

T&D Subscription Software— The Software Monthly

T&D has been offering subscription software for CoCo users for a long time. If you subscribe, each month you receive a package by mail that contains your choice of a 5¼-inch disk or a cassette tape. Either one is chocked full of useful programs for all models of the CoCo. Each disk/tape contains a nice variety of software consisting of games, utilities and home/business programs.

Each issue contains 10 programs complete with documentation on disk or tape and loading instructions where necessary. A supplement sheet that comes with each issue contains a list of the programs with appropriate PMODE and PCLEAR values as well as tape count locations for CTR-80A and CCR-81 tape recorders. I had a chance to look over the October 1989 issue and was impressed with the programs it contained. Here's what I found:

- *Sales Prospecting* — a powerful sales prospecting and tracking program that includes a report generator for appointment schedules and expenses.
- *Virus 3* — a CoCo 3 game played on simulated circuit boards.
- *Will Maker* — a program that describes the typical parts of a legal will, providing inputs resulting in a printed will for the user.
- *General Journal* — an accounting program that works with a purchase order program that appeared in the September issue. You can create 69 different accounts and post credits and debits of 500 entries to each account.
- *Police Cadet #5* — a CoCo 3 adventure game that challenges you to track down a criminal.
- *Red Dog* — a cute card game between you and three computer opponents. The object is to bet that your middle card is higher or lower than your opponent's.
- *Mad Libbs* — a funny idea — you have to finish six unfinished stories by adding names, places, etc.
- *Macintosh Picture Saver* — a utility that lets you view and save Macintosh picture files as PMODE files. Having done this, you can then edit and print the picture using existing editors and screen printers.
- *Frog* — a cute game where, as a frog, you must jump up and down in your pond to catch flying insects.
- *P51 Flight Simulator* — a very nice and realistic flight simulator from the Tom Mix line that puts you behind the controls of a P51 fighter plane. It works by itself, or you can play it "dogfight" fashion with a friend over a modem or between two local computers with RS-232 hook-up provided.

T&D Subscription Software has a lot to offer the CoCo enthusiast. It's an excellent chance to add to your CoCo library without having to key in any listings. The concept of "subscription software" makes sense, and the variety and quality of what T&D has to offer will make the mailman's delivery even more exciting.

(T&D Software, 2490 Miles Standish Drive, Holland, MI 49424, 616-399-9648; $8 per issue, $70 for yearly subscription)

—Robert Gray

Received and Certified

The following products have recently been received by THE RAINBOW, examined by our magazine staff and issued the Rainbow Seal of Certification, your assurance that we have seen the product and have ascertained that it is what it purports to be.

CoCo Federal Tax 1989, 7th ed., a tax program for individuals and small businesses. "It completely performs the tax form preparation function for those who prepare taxes; and it provides a means to those who would like to apply their CoCo to the task of mastering federal taxation." Covers Form 1040 schedules A, B, C, D and E, along with forms 2106, 4562, 2441 and 8615. *Puritas Springs Software, The Ameritrust Building, 17140 Lorain Ave., Cleveland, OH 44111, (216) 251-8085; $39.95.*

Hot CoCo!, a cassette tape of original music performed with the aid of the Tandy Color Computer, *Lyra* and *CoCo MIDI 3*. Features music by Val Burke, Mike Stute, Mark Steele and Lester Hands. Selections include "*What?*," "*I Cry for Tian Anmen*," "*Mists*," "*The Order of Time*" and "*March of the Miniature ET Warriors*." *Musicware, available through Rulaford Research, P.O. Box 530328, San Diego, CA 92153, (619) 690-1181; $9.95.*

KJV on Disk #7, chapters 19 through 36 of the Book of Numbers in the King James version of the Bible, in ASCII files for the CoCo 1, 2 and 3. A word processor or text editor is required for viewing the files. *BDS Software, P.O. Box 485, Glenview, IL 60025, (312) 998-1656; $3.*

Predator, a 30-stage CoCo 3 game on a ROM pack, based on the movie of the same name. As Major Dutch Schaffer, your jungle commando unit is in danger when an alien hunter selects you and your men as his next prey. Not only must you contend with the alien but also enemy guerrillas, scorpions, rolling rocks and the Predator's pets. The first goal is to find a weapon (machine gun, laser rifle or grenade). In addition to firing a weapon, Dutch's defenses include punching and jumping. Game control is provided via keyboard or joystick (a two-button model is required). *Activision, dist. by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX 76102; $34.95: Available in Radio Shack stores nationwide, Cat. No. 26-3165.*

Print5, a set of screen-printing utilities for OS-9 Level II and the CoCo 3. It works on Type 5 graphics screens and types 1 and 2 text screens. A DMP-105/130 or compatible printer required. (The company notes that extra drivers are in the works, and it also makes an offer to tailor the printer driver to your CoCo 3 compatible printer for a shipping/handling fee.) *G.T.T.D. Software, P.O. Box 187, Pablo, MT 59855, (406) 883-2306; $23.95 plus $2 S/H ($17.95 plus $2 S/H introductory price in effect until May 1, 1990).*

RoboCop, a CoCo 3 ROM pack action arcade game based on the movie of the same name. After a sadistic crime wave has swept through old Detroit, a private corporation (O.C.P.) takes on the city's law enforcement contract and develops a law enforcement cyborg, RoboCop. Your mission as RoboCop is to "stop every sleazeball criminal you encounter with deadly, piercing accuracy." Your weapons include the Auto 9 special-issue hand gun, a machine gun and the Cobra gun. Game control is provided by keyboard or joystick (a two-button joystick is required). *Data East, dist. by Tandy Corporation, 1700 One Tandy Center, Fort Worth, TX; $34.95: Available in Radio Shack stores nationwide, Cat. No. 26-3164.*

Slot-Pak II, a pack-sized hardware bus expander that plugs into the CoCo's side slot, designed to replace Tandy's discontinued Multi-Pak for CoCos 1, 2 and 3. It sits on a plastic brace and has three connectors on top, allowing the use of three plug-in cartridges at the same time (not supporting the use of game packs). It can house a floppy disk controller, a hard disk controller and a serial port pack, for example. Slots 1 and 2 are switchable through software by pokes or through machine language programming. "Slots 1 and 2 also respond correctly when called 3 and 4, so software written for the Tandy Multi-Pak will work correctly." *Howard Medical Company, Box 2, Chicago, IL 60690, (312) 278-1440 or 800-443-1444; $89.45.*

T&D Software's Grafix Disk Package Set 1, a collection of 10 disks with clip art, space pictures, animals and more. A viewing program is included that lets you load and view a file. You can slide pictures up, down, left and right. Screens can be saved out to CoCo `PMODE 4` format for later editing. Also, the graphics editor *McPaint* is included. *T&D Subscription Software, 2490 Miles Standish, Holland, MI 49424, (616) 399-9648; $35.*

T&D Software's Grafix Disk Package Set 3, a collection of 10 disks full of graphics files of "adult-only, R-Rated, beautiful women." *T&D Subscription Software, 2490 Miles Standish, Holland, MI 49424, (616) 399-9648; $35.*

T&D Subscription Software Disk 91, the January 1990 issue of a software subscription product. Disk #91 contains *Trench Fighter*, *CoCovert 3*, *Speed Games*, *Business Starter*, *Cavern Quest 3 Part 2*, *Builder Helper*, *Tarzar IV*, *Address It*, *Animal Graphics* and *SkyWay*. Each issue contains a mix of games, productivity programs, utilities and more. *T&D Subscription Software, 2490 Miles Standish Drive, Holland, MI 49424, (616) 399-9648; $8; yearly subscription $70.*

First product recieved from this company

The *Seal of Certification* is open to all manufacturers of products for the Tandy Color Computer, regardless of whether they advertise in THE RAINBOW.

By awarding a *Seal*, the magazine certifies the program does *exist* — that we have examined it and have a sample copy — but this *does not* constitute any guarantee of satisfaction. As soon as possible, these hardware or software items will be forwarded to THE RAINBOW reviewers for evaluation.

Thanks for the Memory

by William Barden, Jr.
Contributing Editor

CoCo 3 512K owners may often wonder why they spent the extra money for additional memory? If you're not an OS-9 aficionado, that extra 384K of memory just sits there laughing in your face as Extended Color BASIC tells you there is only 22K of memory available! Actually, it's not too hard to take advantage of that extra memory. For 128K CoCo 3 owners, it's even possible to take advantage of the extra 64K. In the best case, a multitasking system is possible on the CoCo 3, rivaling OS/2 on PC-compatible systems. Although I can't show you a complete operating system that can run three programs simultaneously on the CoCo in a short column, I *can* show you what's involved in using the CoCo 3's expanded memory for storing and retrieving high-resolution screens and BASIC data.

Mapping the CoCo 3's Memory

The first step in this adventure lies in understanding how the CoCo uses memory. All Color Computers use variations of the Motorola 6809 microprocessor, a well-thought-out programmer's jewel (when contrasted with the offspring of the Intel 8085 through 8088 and their relatives used in MS-DOS systems). The 6809, like the comparable 6502 and 6800 microprocessors, use a 64K-byte addressing space. This means that 6809 instructions can access data in locations 0 through 65535 and no other higher locations. Hexadecimal representations of 0 through 65535 are $0000 to $FFFF, where the dollar sign indicates hexadecimal; each $2000 increment represents 8192 bytes or 8K of memory. Hex $4000, for example, is the same as 16K (16,384). Hex $6000 is 24K (24,576).

The CoCo 1 and 2 use the first 32K bytes of this 64K addressing space for RAM (Random Access Memory). In this RAM area are system variables, text and graphics screens, a BASIC program, variables, arrays, string space, a stack and possible machine language programs as shown in Figure 1.

The upper 32K bytes of the 64K addressing space is used for ROM (Read Only Memory). Software is semi-permanently or permanently burned into a ROM chip and normally cannot be changed. On the CoCo 1 and 2, Color BASIC, Extended Color BASIC, Disk BASIC and software cartridges are contained in ROM. So far, so good.

In the early days of the CoCo and other computers, we thought we owned the world — anything could be run in that 32K of RAM! However, the 6809 was superseded by more powerful microprocessors that could address more memory locations. The 8088 used in early MS-DOS systems and some current low-end systems can address one million bytes of memory. Only 640K of this is designated as user memory, however. The remainder is used for Input/Output device addresses (such as video display RAM) and system use.

When Radio Shack made the decision to design the CoCo 3, they were in a dilemma. If they used a newer microprocessor, it might mean the existing base of CoCo software would not be compatible on the new CoCo 3 systems. Also, a new, more powerful microprocessor might make the CoCo nearly as good as their MS-DOS systems, and that would never do for sales. On the other hand, the Shack was committed to OS-9, the incredibly easy-to-use operating system of the future. Was there a scheme that would make the CoCo 3 *downward compatible* with CoCo 1 and 2 software and yet provide more memory for OS-9? The answer was an elegant and powerful scheme of *memory management*.

Figure 2 shows the basic approach to the CoCo 3's memory mapping. The CoCo 3 is designed to have a maximum of 512K bytes of memory, almost as much as MS-DOS systems. The BASIC 128K system is divided into two 64K partitions. The upper 64K (memory locations $70000 through $7FFFF) is normally used for CoCo 1 and 2 programs. While in this mode, CoCo 1 and 2 programs run as they did on 64K CoCo 1 and 2 systems. Addresses $70000 through $7FFFF were remapped by the hardware into locations $0000 through $FFFF (the prefix 7 was effectively lopped off as shown in Figure 2).

The lower 64K of the 128K BASIC system ($60000 through $6FFFF) holds high-resolution screens and buffers. The 640-by-192, high-resolution mode, for example, uses 2 bits per pixel or 245,760 bits, which is 30,720 bytes; so 32K (32,768 bytes) is dedicated to storing the Hi-Res graphics buffer. Likewise the high-resolution 80-by-24 text screen requires about 8K of storage with color attributes. A special 8K area is reserved for an HGET/HPUT buffer storage area. There is also an 8K area for a secondary stack;

Bill Barden has written 35 books and hundreds of magazine articles about small computers. His newest Color Computer book is "Connecting the CoCo to the Real World", a book of CoCo interfacing projects. He has over 20 years experience in the industry on systems ranging from mainframes to micros.

the final 8K of the basic 128K system is unused.

The question is just how does the 6809 chip address the lower 64K bytes of memory? The CoCo 3 designers could have switched between the upper and lower 64K, depending upon whether the CoCo 3 was in Hi-Res mode or Normal mode. Instead, they decided on a memory-management scheme using 8K blocks. The GIME chip, a special purpose graphics- and memory-management device, incorporates an MMU or memory-management unit. Each register in the MMU controls one 8K block of physical memory. There are 64 possible 8K blocks of memory in a 512K system, as shown in Figure 3; they start at locations $00000, $02000, $04000, $06000, $08000, $0A000, $0C000, $0E000, $10000, $12000 and so forth. At any given time, eight of these 8K blocks can be assigned to logical addresses of blocks 0, 1, 2, 3, 4, 5, 6, 7 and 8. The logical blocks would start at $0000, $2000, $4000, $6000,$8000, $A000, $C000 and $E000, corresponding to those memory locations in the CoCo 1 and 2. Any program, old or new, will function as if it has only 64K bytes available, even though the physical blocks it is addressing are the high-resolution graphics or text screens as shown in Figure 3.

A program controlling the CoCo 3 can literally be located anywhere in the 512K bytes of possible memory, spread about in eight 8K blocks. However, CoCo 3 BASIC operates in two general modes. In the standard (CoCo 1 and 2) mode only the top eight 8K blocks are used in a straightforward fashion. The CoCo 3 addresses $70000 through $7FFFF to get corresponding locations $0000 through $FFFF. In the Hi-Res mode, a mixture of eight 8K blocks in the $60000 through $6FFFF area and $70000 through $7FFFF area are used as shown in Figure 4.

A few words about CoCo 3 BASIC: In the CoCo 1 and 2, Extended Color BASIC is in ROM and adds features to Color BASIC in another ROM. Disk BASIC is in yet another ROM and adds features to Extended Color BASIC and Color BASIC. CoCo 3 BASIC moves all of these ROMs into RAM, patches a few locations and adds additional code to handle the new features, most of which relate to high-resolution text and graphics. Once the code is moved, the BASIC code in ROM is ignored. CoCo 3 BASIC is located in physical address $7E000 to $7FDFF (Block 63). Because all BASIC code is resident in RAM, it may be patched to modify functions and add capabilities.

When you upgrade a CoCo 3 to 512K, you are adding additional memory to physical locations 0 through $5FFFF — 384K bytes total. CoCo 3 BASIC does not use this expanded memory, because it is much easier to ignore it, leaving it to OS-9 or application programs that take advantage of it. Consider the possible conditions under which Microware performed the work and the restric-

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William Barden Jr.
Color Computer Products

You know me from **Barden's Buffer** in **Rainbow** and from Radio Shack's **Color Computer Assembly Language Programming, Color Computer Graphics, and Color Computer and MC-10 Programs** books. I love the CoCo so much that I have a new book and an exciting new CoCo Weather Station Project I think you'll enjoy.

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tions that Radio Shack may have imposed upon it. Let's continue and see just how this area can be put to good use.

Addressing Memory

CoCo 3 BASIC does have some capability to address all 512K bytes of memory. The LPEEK and LPOKE statements allow any byte to be read or modified in the 512K memory space. A typical program to read the first 8K in a 512K system is as follows:

```
100 FOR I=&H00000 TO &H20000
110 PRINT LPEEK(I);
120 NEXT
```

The LPOKE statement allows you to modify the memory locations as well. For example, to draw a line in the upper left-hand corner of the high-resolution graphics screen, type and run this:

```
100 HSCREEN 4
110 HCLS
120 LPOKE &H60000,255
999 GOTO 999
```

You would think you could do a great deal with LPEEK and LPOKE — saving blocks of memory to disk, storing arrays, swapping graphics screens and the like. Unfortunately, LPEEK and LPOKE have one bad feature — they're just too slow. It takes 15 seconds short of five minutes to clear a high-resolution graphics screen in slow-speed mode using LPOKE.

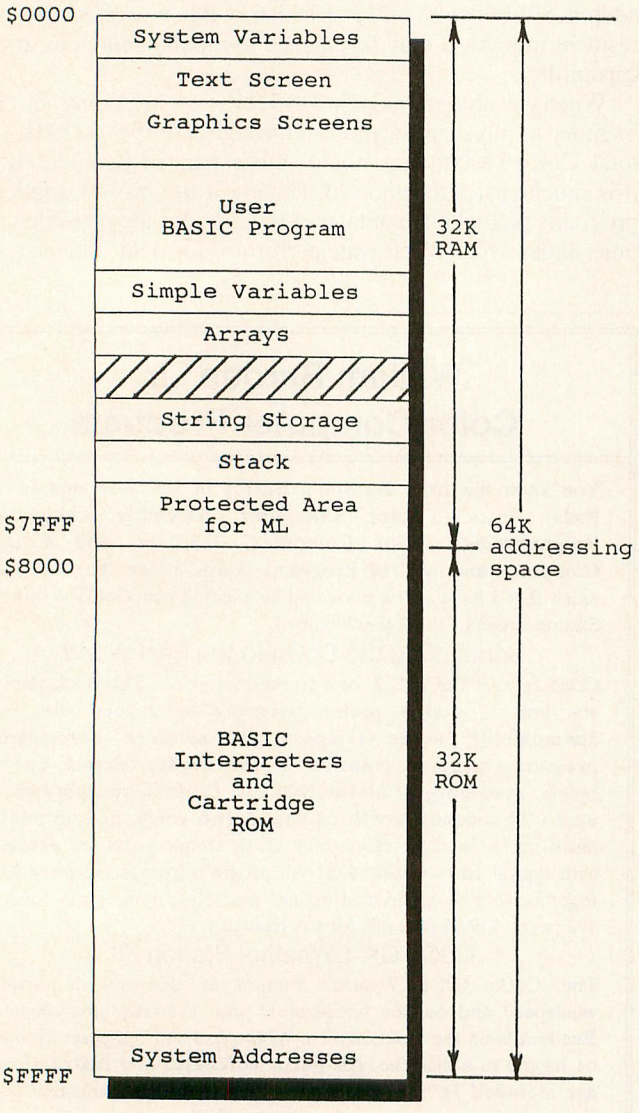

Figure 1: CoCo 1 and 2 Memory Use

Using Expanded Memory

Since we can't practically use LPEEKs and LPOKEs, just how can we use expanded memory? One approach is to add a great deal of code to modify CoCo 3 BASIC to address all memory. However, it would be an enormous amount of work. Another approach is to speed up LPEEK and LPOKE, which may be possible without a great deal of trouble. You can implement a block LPEEK or LPOKE, for example, most likely by using a format such as LPOKE *XXXX,ARRAY* and LPEEK(*XXXX*),*array*.

The method I chose was a little more straightforward and provides some flexibility. I chose to write an assembly language subroutine that moves any 8K block to any other 8K block in memory and supports it with a BASIC memory manager. The memory manager allows you to store up to 12 high-resolution graphics screens in memory, read them back or store them on disk. It also allows you to store or read up to 48 high-resolution text screens using the same operations or to store or read up to 48 HGET buffer arrays as well.

High-Speed Block Transfer

The key to the memory manager is a high-speed assembly language block transfer subroutine that moves any 8K block to any other 8K block. It's shown in Listing 1.

The code is pretty simple if you know how the CoCo 3 addresses memory. The CoCo 3 uses addresses $FFA0 through $FFA7 to set up the MMU registers. The MMU registers define which physical addresses are assigned to logical blocks 0 through 7 to make up the 64K addressing space. If you store 56, 57, 58, 59, 60, 61, 62 and 63 in these locations, for example, you'll have a standard configuration that maps locations $70000 through $7FFFF to the 64K logical addressing map. Store 56, 48, 49, 50, 51, 61, 53 and 63 in these locations and you'll have a configuration that addresses the high-resolution graphics screen.

Actually, there are two sets of MMU registers: one set of eight at locations $FFA0 through $FFA7 and a second set at locations $FFA8 through $FFAF. The CoCo 3 can switch between these two sets of memory configurations in an instant by selecting one set or the other, which is done by setting Bit 0 of Location $FF91 to 0 or 1. This ability makes it easy to switch between the standard mode and Hi-Res graphics mode — just set up the two sets of MMU registers and then change Bit 0 of $FF91. This is exactly how CoCo 3 BASIC does the task-switching. (Setting Hi-Res text mode is handled by substituting the text screen block number for the graphics screen block number when setting up the MMU registers.)

The first line in the assembly-language code calls the subroutine at $B3ED. This is a standard call to convert a BASIC parameter to an integer form in the A and B registers. The ORCC instruction disables the 6809 interrupts for the duration of the subroutine. The

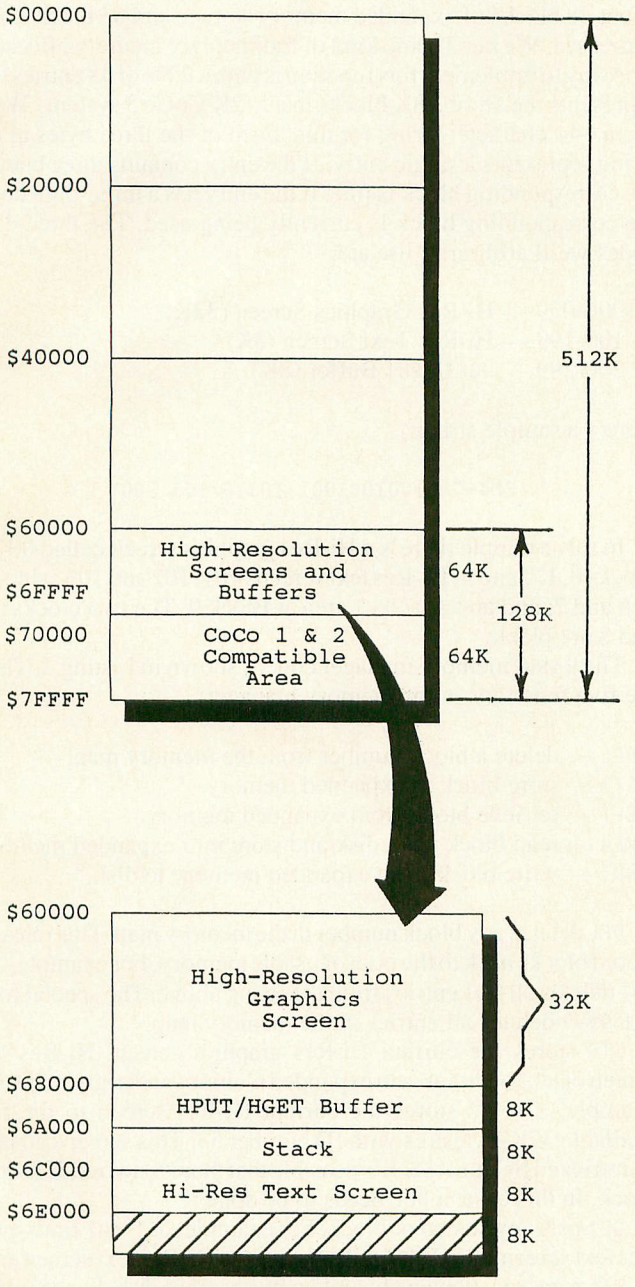

Figure 2: CoCo 3 Memory Map

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next four instructions set a source 8K block into logical Block 0 and a destination 8K block into logical Block 1. Logical blocks 0 and 1 normally hold system variables and the text screen or graphics screens, but as long as the operation can be completed within this assembly-language subroutine, we don't have to worry about CoCo 3 BASIC needing to access system variables.

The LOOP subroutine loads 8192 bytes from the source block and transfers the bytes to the destination block. The source block is remapped to locations $0000 through $1FFF but is really anywhere in memory. The destination block is remapped to locations $2000 through $3FFF but is also anywhere in memory. In the loop, the X register holds the index of 0 through $2000, which is 8192.

After the transfer is made, a call to the CoCo 3 BASIC subroutine SETMMU restores the MMU registers to their normal values. The AND instruction reenables 6809 interrupts; the RTS returns to BASIC.

The assembly language subroutine is called from BASIC by a USR9 (*source**256+*dest*) call. For example, to move the first 8K bytes of the Hi-Res graphics screen at locations $60000 through $61FFF, the source block is Block 48. The destination block might be the 8K bytes at locations $02000 through $03FFF (Block 1). In this case the call would be as follows:

```
200 USR9(48*256+1)
```

The USR call normally allows you to use ten different calls, numbered USR0 through USR9. I chose USR9 in case you wanted other machine-language calls numbered from 0. The USR9 call must be preceded by a definition of where in memory the machine language code is. In this case the code resides in locations $5F00 through $5F26, so the definition is as follows:

```
100 DEFUSR9=&H5F00
```

The assembly language code was designed to run starting at the $5F00 area of memory in order to leave the 8K block at $6000 through $7FFF free as a memory buffer for writing and reading disk data. The area starting at $5F00 up to $7FFF must be protected with the following line:

```
50 CLEAR 2000,&H5EFF
```

The first value clears a string area and may be adjusted according to your needs; 2000 is an arbitrary value.

The only non-relocatable machine language instruction is the LBSR, which calculates the branch address by adding $5F24 (the address of the instruction in memory) to the displacement value in the instruction $8173 (as defined within the program but not listed) to obtain $E097, the CoCo 3 BASIC location of the SETMMU subroutine.

The subroutine is much faster than an LPEEK or LPOKE. It transfers 8K bytes of memory in about ¼ of a second in the slow-speed mode.

The BASIC Memory Manager Code

Now that we have an assembly language block transfer program, how do we utilize it in a memory manager? First, let's give some thought to what we want to put in memory. High-resolution graphics screens are up to 32K bytes long. This means that four 8K blocks must be transferred. It would be convenient to save graphics screens in expanded memory to recall and display at any time. Some limited animation might even be done at the rate of about two screens per second in high-speed mode. It also might be advantageous to save and recall high-resolution text screens. Text screens are only 8K bytes long and require just one block transfer. It's also good to save and restore the HGET/HPUT buffer area, which defines graphics blocks to be saved. Again, these require only one block transfer.

Since we might be mixing screens and other blocks and have 384K bytes to play with on a 512K CoCo 3 system, we're talking about 48 blocks of expanded memory storage and 63 blocks to be addressed. We need some kind of rudimentary memory allocator. One way to implement this function is with a table of 48 entries that represents the 48 free 8K blocks in a 512K CoCo 3 system . We'll use a 144-character string for this. Each of the three bytes in the string represents a single entry. If the entry contains three blanks, the corresponding block is free. If the entry has a three-digit code, the corresponding block is currently being used. The three-digit codes we'll arbitrarily use are:

000-099 — Hi-Res Graphics Screen (32K)
100-199 — Hi-Res Text Screen (8K)
200-299 — HGET/HPUT Buffer (8K)

Here's a sample string:

```
ZM$="001001001001 101102103 200"
```

In this example there's a Hi-Res graphics screen called 001 in blocks 0, 1, 2 and 3; Hi-Res text screens 101, 102 and 103 at blocks 5, 6 and 7; and an HGET/HPUT area at Block 9. The two blocks at 4 and 8 are blank.

The BASIC memory manager code is shown in Listing 2. There are five functions in the memory manager:

- DEL — delete a block number from the memory map.
- STR — store block in expanded memory.
- GET — retrieve block from expanded memory.
- REA — read block from disk and store into expanded memory.
- WRI — write block from expanded memory to disk.

DEL deletes any block number in the memory map. This releases stored blocks back to the pool of usable memory. For example, DEL 001 deletes all 001 entries from the string above. The special form DEL 9999 deletes all entries in the memory map.

STR stores the current Hi-Res graphics screen, Hi-Res text screen or HGET/HPUT area in expanded memory with a given ID. For example, STR 53 stores the current Hi-Res screen to the first available 32K-byte area with ID number 53. This screen can later be retrieved by a GET 53. It's possible that there is no free 32K-byte block. In this case, a DEL needs to be done.

GET gets any screen or block. For example, GET 107 finds a Hi-Res text screen called 107 and puts it in the Hi-Res text screen area.

REA reads any previously written blocks from disk. For example, REA 73 searches for four disk files for a Hi-Res graphics screen called EM073/1, EM073/2, EM073/3 and EM073/4 and reads them into expanded memory with an ID equal to 073. Note that the data is read into expanded memory and is not displayed.

WRI writes any Hi-Res graphics screen in expanded memory as four disk files: EMOXX/1, EMOX/2, EMOXX/3 and EMOXX/4 or a Hi-Res text screen as EM1XX/1 or an HGET/HPUT area as EM2XX/1.

Using the Memory Manager

Using the memory manager with your own BASIC code is easy.

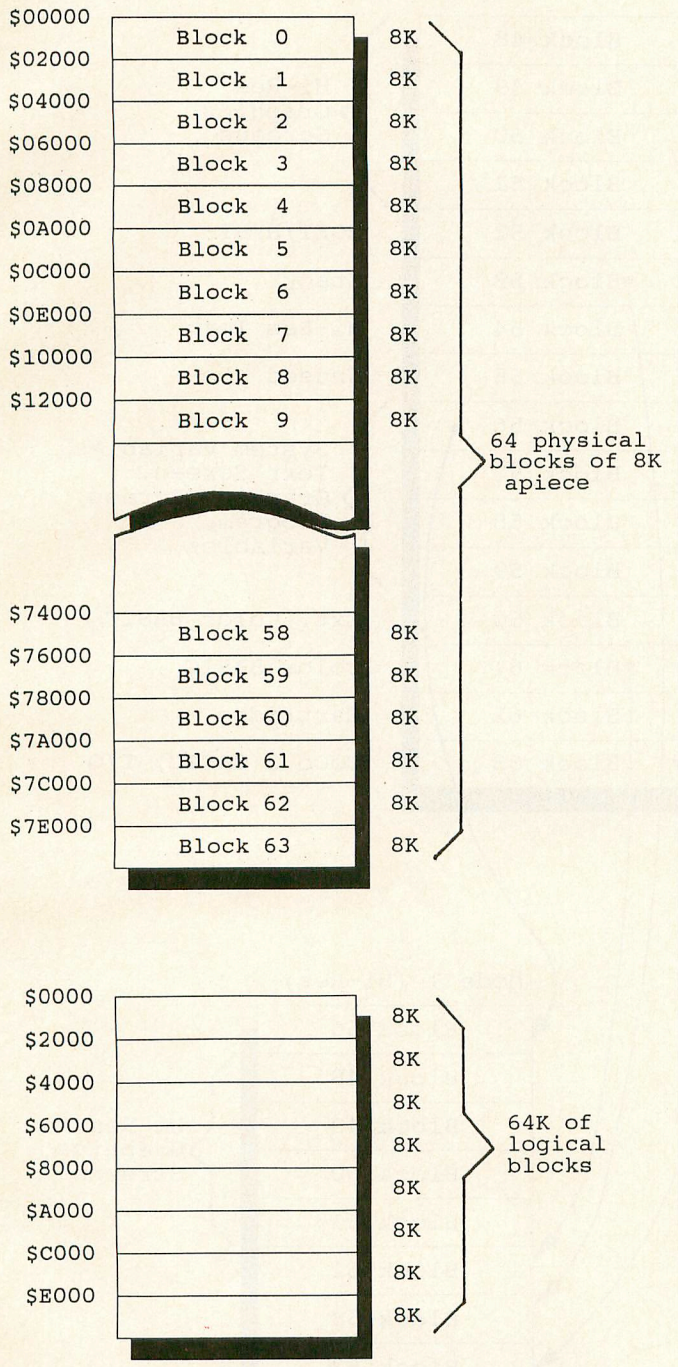
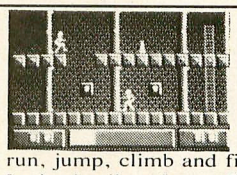


Figure 3: CoCo 3 Physical and Logical Blocks



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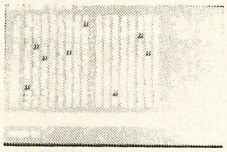

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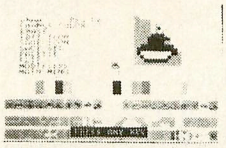

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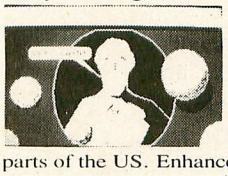

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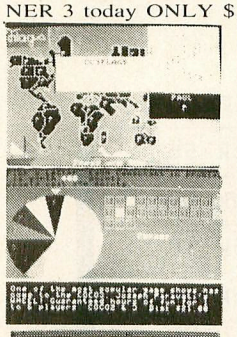

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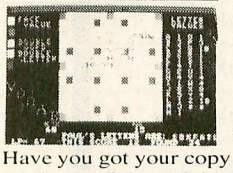

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Type CLEAR 2000,&H5EFF as your first BASIC statement, to protect memory. Enter the entire subroutine and merge it with your existing code. Since it starts at Line 10000, this should be no problem with most programs. Call the subroutine with two variables, ZF$ and ZC$. The ZF$ variable should contain one of the strings DEL, STR, GET, REA or WRI for the delete, store, get, read or write functions. ZC$ is the ID code for the block — 000 through 099 for graphics screens; 100 through 199 for text pages; and 200 through 299 for HGET/HPUT areas. Note that these codes can be any values — they are not related to the memory block used.

The first time the subroutine is called, it moves the machine code data values into protected memory. Thereafter, no move is made. Also, on the first time, the memory map is reset to all blanks, indicating that the entire 384K bytes of expanded memory are available.

After every call, check Variable ZE. If it is a 0, the function was performed correctly. If it is not zero, an error has occurred either because there was no room for storage (an existing ID on a store or read) or because an ID was not found on a retrieval.

Listing 3 shows a sample program that stores and retrieves Hi-Res graphics screens from memory and disk.

Storing Variable Data

It's a major chore to store strings in expanded memory. Strings in all versions of BASIC are fragmented — they don't exist as a contiguous

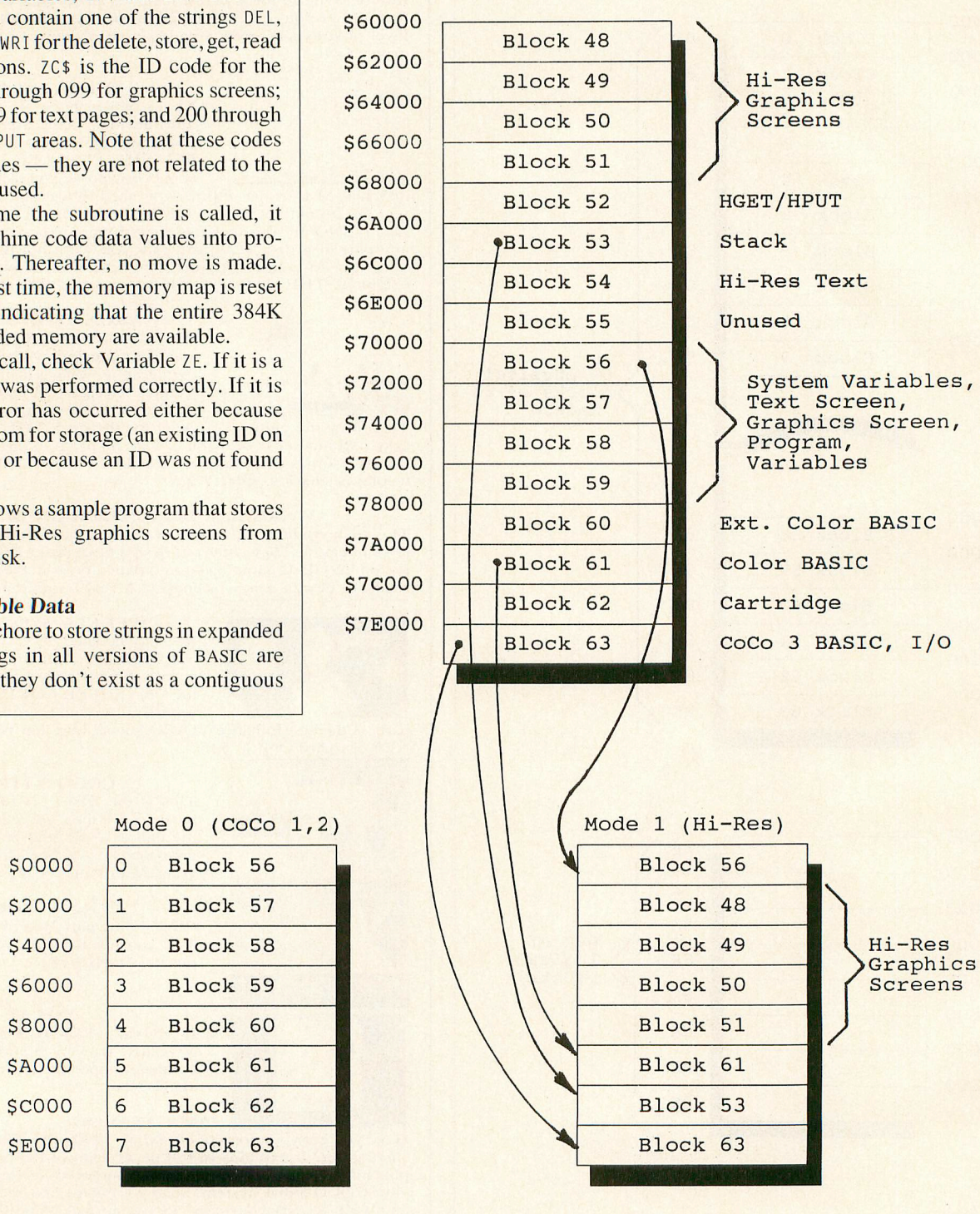

Figure 4: CoCo 3 Modes

block but may be spread out over the program area (literal strings) or string storage area. However, you can store strings in the Hi-Res graphics, Hi-Res text or HGET/HPUT areas and then store this data in expanded memory. You'll have to first LPOKE the characters one by one into one of these areas and then store the area to expanded memory. You can then read back the string by retrieving the area and using LPEEK to read the data. Numeric arrays can be handled in the same fashion. These storage techniques are slower than the other memory manager functions, but you can utilize all expanded memory to store up to 384K characters of data.

128K Systems

Although the memory manager is designed for 512K CoCo 3s, the assembly-language subroutine will work with 128K systems. Use it to transfer data between any 8K blocks in the system, for example, between the protected memory area at $76000 through $77FFF and any portion of the lower 64K-byte area that's convenient to use. Remember, if you don't use Hi-Res graphics or text, there's still an additional 64K bytes of memory at your disposal.

Other Possibilities with Expanded Memory

While writing this column, I realized that there is a good chance that the CoCo 3 can be turned into a multitasking system like OS/2 without a great deal of trouble. Load three or four programs into expanded memory and then change the MMU registers rapidly to switch between them — without OS-9. This merits more thought and I might present something along these lines in a later column if a reader doesn't beat me to it. If you're interested in a task such as this, by the way, a good starting point is the set of excellent books from Microcom Software called *Color BASIC Unravelled*, *Extended Color BASIC Unravelled*, *Disk BASIC Unravelled*, and *Super Extended BASIC Unravelled*. They list complete disassembled code for the four BASICs in great detail, along with descriptive text. I always marvel at the amount of work that went into them. You'd be hard pressed to find such data in the MS-DOS arena!

See you next month with more CoCo topics. ❑

Editor's Note: The assembly language listing is included for reference only and will not appear on this month's RAINBOW ON TAPE/DISK.

Listing 1:

```
START   JSR   $B3ED       GET PARAMETERS
        ORCC  #$50        DISABLE INTERRUPTS
        STA   $FFA0       SOURCE TO LOGICAL BLK 0
        STA   $FFA8
        STB   $FFA1       DEST TO LOGICAL BLK 1
        STB   $FFA9
        LDX   #0          CLEAR INDEX
LOOP    LDA   ,X            GET BYTE FROM SOURCE
        STA   $2000,X       STORE IN DESTINATION
        LEAX  1,X           BUMP INDEX
        CMPX  #$2000        INDEX=8192 AT END
        BNE   LOOP          GO IF NOT DONE
* CHANGE THE 2ND AND 3RD BYTES TO RELOCATE HERE
        LBSR  SETMMU      RESTORE MMU REGISTERS
        ANDCC #$AF        ENABLE INTERRUPTS
        RTS               RETURN TO BASIC
```


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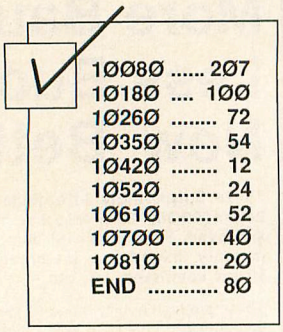
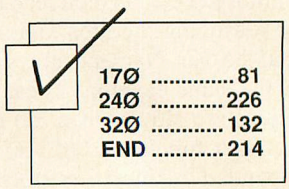


```
1ØØ8Ø ..... 2Ø7
1Ø18Ø .... 1ØØ
1Ø26Ø ..... 72
1Ø35Ø ..... 54
1Ø42Ø ..... 12
1Ø52Ø ..... 24
1Ø61Ø ..... 52
1Ø7ØØ ..... 4Ø
1Ø81Ø ..... 2Ø
END ..... 8Ø
```

Listing 2: MANAGER

```
10000 ' COCO 3 MEMORY MANAGER
10010 '
10020 IF ZZ=0 THEN ZZ=1 ELSE GOT
O 10150
10030 '
10040 ' INITIALIZATION
10050 DATA BD,B3,ED,1A,50,B7,FF,
A0,B7,FF,A8,F7,FF,A1,F7,FF,A9,8E
,00,00
10060 DATA A6,84,A7,89,20,00,30,
01,8C,20,00,26,F3,17,81,73,1C,AF
,39
10070 FOR I=&H5F00 TO &H5F00+38
10080 READ A$: POKE I,VAL("&H"+A
$)
10090 NEXT I
10100 DEFUSR9=&H5F00
10110 ZM$=STRING$(48*3," ")
10120 RETURN
10130 '
10140 ' COMMAND DECODE
10150 ZE=0
10160 ZA=INSTR("DELSTRGETREAWRI"
,ZF$)
10170 IF ZA=0 THEN ZE=1: GOTO 10
940
10180 ZA=(ZA+2)/3
10190 ON ZA GOTO 10210,10290,104
70,10590,10780
10200 '
10210 ' DEL(ETE) FUNCTION - DELE
TES ENTRY FROM MAP
10220 GOSUB 10910
10230 IF ZC$="999" THEN ZM$=STRI
NG$(48*3," "): GOTO 10940
10240 ZA=INSTR(ZM$,ZC$)
10250 IF ZA=0 THEN ZE=1: GOTO 10
940
10260 IF VAL(ZC$)<100 THEN MID$(
ZM$,ZA,12)="            " ELSE M
ID$(ZM$,ZA,3)="   "
10270 GOTO 10940
10280 '
10290 ' ST(O)R(E) FUNCTION - STO
RES BLOCK TO MEMORY
10300 GOSUB 10910
10310 ZA=INSTR(ZM$,ZC$)
10320 IF ZA<>0 THEN ZE=1: GOTO 1
0940
10330 IF VAL(ZC$)<100 THEN ZB$="
          " ELSE ZB$="   "
10340 ZA=INSTR(ZM$,ZB$)
10350 IF ZA=0 THEN ZE=1: GOTO 10
940
10360 IF VAL(ZC$)<100 THEN ZC$=Z
C$+ZC$+ZC$+ZC$
10370 MID$(ZM$,ZA,LEN(ZC$))=ZC$
10380 ZB=(ZA-1)/3
10390 ZC$=LEFT$(ZC$,3)
10400 IF VAL(ZC$)<100 THEN ZD=48
 ELSE IF VAL(ZC$)<200 THEN ZD=54
 ELSE IF VAL(ZC$)<300 THEN ZD=52
 ELSE ZE=1: GOTO 10940
10410 IF VAL(ZC$)<100 THEN ZF=3
ELSE ZF=0
10420 FOR ZI=0 TO ZF
10430 A=USR9((ZD+ZI)*256+ZB+ZI)
10440 NEXT
10450 GOTO 10940
10460 '
10470 ' GET FUNCTION - GETS BLOC
K FROM MEMORY
10480 GOSUB 10910
10490 ZA=INSTR(ZM$,ZC$)
10500 IF ZA=0 THEN ZE=1: GOTO 10
940
10510 ZB=(ZA-1)/3
10520 IF VAL(ZC$)<100 THEN ZD=48
 ELSE IF VAL(ZC$)<200 THEN ZD=54
 ELSE IF VAL(ZC$)<300 THEN ZD=52
 ELSE ZE=1: GOTO 10940
10530 IF VAL(ZC$)<100 THEN ZF=3
ELSE ZF=0
10540 FOR ZI=0 TO ZF
10550 A=USR9((ZB+ZI)*256+ZD+ZI)
10560 NEXT
10570 GOTO 10940
10580 '
10590 ' REA(D) FUNCTION - READS
BLOCK FROM DISK FILE
10600 GOSUB 10910
10610 ZA=INSTR(ZM$,ZC$)
10620 IF ZA<>0 THEN ^E=1: GOTO 1
0940
10630 IF VAL(ZC$)<100 THEN ZB$="
          " ELSE ZB$="   "
10640 ZA=INSTR(ZM$,ZB$)
10650 IF ZA=0 THEN ZE=1: GOTO 10
940
10660 IF VAL(ZC$)<100 THEN ZC$=Z
C$+ZC$+ZC$+ZC$
10670 MID$(ZM$,ZA,LEN(ZC$))=ZC$
10680 ZB=(ZA-1)/3
10690 ZC=59
10700 ZC$=LEFT$(ZC$,3)
10710 IF VAL(ZC$)<100 THEN ZF=3
ELSE ZF=0
10720 FOR ZI=0 TO ZF
10730 LOADM"EM"+ZC$+"/"+RIGHT$(S
TR$(ZI),1)
10740 A=USR9(ZC*256+ZB+ZI)
10750 NEXT
10760 GOTO 10940
10770 '
10780 ' WRI(TE) FUNCTION - WRITE
S BLOCK TO DISK FILE
10790 GOSUB 10910
10800 ZA=INSTR(ZM$,ZC$)
10810 IF ZA=0 THEN ZE=1: GOTO 10
940
10820 ZB=(ZA-1)/3
10830 ZC=59
10840 IF VAL(ZC$)<100 THEN ZF=3
ELSE ZF=0
10850 FOR ZI=0 TO ZF
10860 A=USR9((ZB+ZI)*256+ZC)
10870 SAVEM"EM"+ZC$+"/"+RIGHT$(S
TR$(ZI),1),&H6000,&H7FFF,&H6000
10880 NEXT
10890 GOTO 10940
10900 '
10910 ' CONVERT ZC$"SUBROUTINE
10920 ZC$=RIGHT$("000"+ZC$,3)
10930 RETURN
10940 RETURN
```



```
17Ø ..... 81
24Ø ..... 226
32Ø ..... 132
END ..... 214
```

Listing 3: SAMPLE

```
100 CLEAR 2000,&H5EFF
105 ' CLEAR MEMORY MAP
106 ZF$="DEL": ZC$="999": GOSUB
10000
110 ' STORE A HI-RES GRAPHICS SC
REEN AS 009
120 HSCREEN 4
130 HCIRCLE (320,100),100
140 ZF$="STR": ZC$="009": GOSUB
10000
150 ' NOW CLEAR THE HI-RES SCREE
N AND STORE NEW SCREEN AS 008
160 HCLS
170 HLINE (100,100)-(150,150),PS
ET,B
180 ZF$="STR": ZC$="008": GOSUB
10000
190 ' STORE A THIRD SCREEN AS 00
3
200 HCLS
210 HLINE (200,100)-(300,150),PS
ET,BF
220 ZF$="STR": ZC$="003": GOSUB
10000
230 ' NOW SAVE ID=009 AS DISK FI
LE
240 ZF$="WRI": ZC$="009": GOSUB
10000
250 ' NOW GET THREE SCREENS IN S
UCCESSION
260 ZF$="GET": ZC$="009": GOSUB
10000
270 ZF$="GET": ZC$="003": GOSUB
10000
280 ZF$="GET": ZC$="008": GOSUB
10000
290 HCLS
300 ' NOW DELETE ID=009
310 ZF$="DEL": ZC$="009": GOSUB
10000
320 HCLS
330 ' NOW READ DISK FILE 009 AND
 THEN DISPLAY
340 ZF$="REA": ZC$="009": GOSUB
10000
350 ZF$="GET": ZC$="009": GOSUB
10000
360 ' NOW DELETE 008 AND THEN TR
Y TO GET IT
370 ZF$="DEL": ZC$="8": GOSUB 10
000
380 ZF$="GET": ZC$="8": GOSUB 10
000
390 GOTO 390
```

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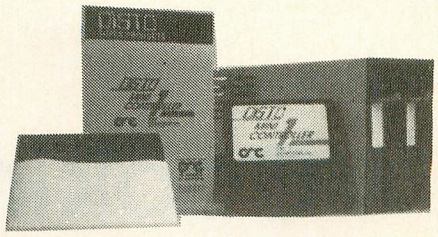

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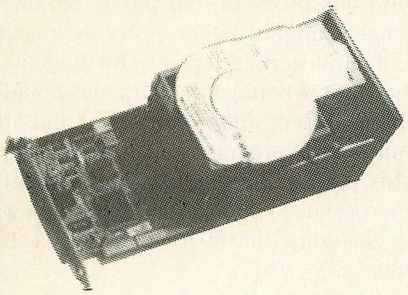

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Cooking With Metric Measures

by Steve Blyn
Contributing Editor

Many children have difficulty learning the metric system. Nevertheless, I must teach this system to my students, not only because metrics is a part of my school's curriculum, but because it is becoming an increasing part of daily living.

Ten years ago it was predicted that the metric system would be our only means of measurement by the 1990s. Surprisingly this has not happened, but that doesn't mean that it won't. In order for our children to be prepared for these changes, they must become familiar with all the various metric measurements while they are in school.

This month I explore one aspect of metric weight—grams. To demonstrate how such matters can become even more confusing than they already are, I have chosen to illustrate an aspect of weight that involves cooking.

One or more cups of an ingredient used in each example is stated in metric measurement and in ounces. Unlike a rose, which is always a rose, a cup is not always a cup in terms of weight. It is not a constant solid amount. A cup's weight varies with the particular cooking ingredient being used.

Steve Blyn teaches both exceptional and gifted children, holds two master's degrees, and has won awards for the design of programs to aid the handicapped. He owns Computer Island and lives in Staten Island, New York.

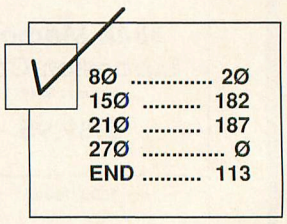
A cup of granulated sugar, for example, weighs approximately 8 ounces or 224 grams, but a cup of powdered sugar weighs only about 4 ounces or 114 grams. With this program the child's task is to convert a certain number of cups of an ingredient into ounces and then into grams.

Ten examples are given in each game. Random children's names are selected for each example. Similarly each example uses a randomly selected ingredient and value to convert. The variables serve to make the program more interesting. Of course you should alter the names chosen on Line 160 to suit your children. You may also increase or decrease the number of names by altering the value of Variable B on that line and then adjusting the number of names used.

The random amount of each ingredient is really a controlled value on Line 150. Variable A varies from 1.5 to 4. Only numbers with decimal values of zero or .5 occur. I did this to make the program easy enough for some students to do most of the examples mentally. You may want to set the random value of A to be either more or less restrictive in your version. This decision depends on your students' abilities and whether or not you want them to solve the problems mentally or on paper.

Each time an incorrect answer is given, the correct answer appears immediately to its right. Variable J controls the scoring. Each correct answer raises the value of J by five points. Since there are two parts to each example and 10 examples, the total score possible is 100 percent.

I thought a scoreboard would be useful with this program, but this is optional. I usually judge whether or not the material will be mastered quickly by the students. In this case, I believe the variables could be changed to prolong the interest and difficulty of the program for quite some time. This indicates to me that a scoreboard is appropriate. You may delete it if you want by changing Line 30 to read `IF X=11 THEN 330`. ❑



The Listing: METRIC

```
10 REM"COOKING WITH METRIC UNITS
"
20 REM"STEVE BLYN,COMPUTER ISLAN
D,STATEN ISLAND,NY,1990"
30 CLS5:XX=RND(-TIMER):X=X+1:REM
"X IS THE COUNTER"
40 IF X=11 THEN 320
50 PRINT@3,"cooking with metric
units";
60 FOR T=1056 TO 1087:POKE T,204
:NEXT T
```

```
70 FOR T=1120 TO 1151:POKE T,195
:NEXT T
80 PRINT@64,"VOLUME (1 CUP)
  WEIGHTS"
90 PRINT@128,"";
100 PRINT"BUTTER              80
Z.  224G."
110 PRINT"GRANULATED SUGAR    80
Z.  224G."
120 PRINT"FLOUR(SIFTED)       40
Z.  112G."
130 PRINT"FLOUR(UNSIFTED)     60
Z.  160G."
140 PRINT"POWDERED SUGAR      40
Z.  114G."
150 A=(2+RND(6))/2
160 B=RND(5):IF B=1 THEN B$="BAR
RY" ELSE IF B=2 THEN B$="MARY" E
LSE IF B=3 THEN B$="SONIA" ELSE
IF B=4 THEN B$="SHARI" ELSE B$="
ANNE"
170 R=RND(5)
180 IF R=1 THEN A$="BUTTER":Z=8:
G=224
190 IF R=2 THEN A$="GRANULATED S
UGAR":Z=8:G=224
200 IF R=3 THEN A$="POWDERED SUG
AR":Z=4:G=114
210 IF R=4 THEN A$="UNSIFTED FLO
UR":Z=6:G=160
220 IF R=5 THEN A$="SIFTED FLOUR
":Z=4:G=112
230 PRINT@320,"#";X;". ";B$" NEE
DS"A;"CUPS OF ":PRINTA$;" THIS T
IME."
240 PRINT@416,"HOW MANY OUNCES I
S THIS";:INPUT Y
250 IF Y=A*Z THEN PLAY"L8CDEGGG"
:J=J+5
260 IF Y<>A*Z THEN SOUND 10,2:PR
INT@441,A*Z
270 PRINT"HOW MANY GRAMS IS THIS
";:INPUT YY
280 IF YY=A*G THEN PLAY"CDEGGG":
J=J+5
290 IF YY<>A*G THEN SOUND 10,2:P
RINT@473,A*G
300 PRINT@490,"press enter";:EN$
=INKEY$
310 IF EN$=CHR$(13) THEN 30 ELSE
 300
320 CLS:PLAY"GFEDCCCC":PRINT"  Y
OUR FINAL SCORE WAS";J;"%":PRINT
330 PRINT"PRESS enter TO PLAY AG
AIN OR eND";
340 EN$=INKEY$
350 IF EN$="E" THEN 360 ELSE IF
EN$=CHR$(13) THEN RUN ELSE 340
360 CLS:END
```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HELICOPTER HERO (THE RAINBOW, 3/88)
4,608 Jerry Anderson, Jacksonville, FL
103 Phil Holsten, Moraga, CA
76 Chris Nuwer, Lockport, NY
HITCHHIKER'S GUIDE TO THE GALAXY *(Infocom)*
400/359 Roy Grant, Toledo, OH
400/422 Jeff Holtham, Waterloo, Ontario
400/510 Brad Wilson, Lithia Springs, GA
IRON FOREST *(Diecom Products)*
5,671,500 Douglas Paulson, Richfield, ID
4,088,000 Gabriel Riley, Richfield, ID
3,173,200 Charles Boyd, Amarillo, TX
JOKER POKER (THE RAINBOW, 3/87)
62,067,906 Carole Rueckert, Mansfield, OH
47,505,822 Blain Jamieson, Kingston, Ontario
21,733,284 Jon Fogarty, Yale, MI
JUNIOR'S REVENGE *(Computerware)*
2,503,000 Stephane Martel, Laval, P.Q.
257,600 Keith Cohen, Rocky Mount, NC
JUNKFOOD (THE RAINBOW, 11/84)
535,760 Charlie Ginn, Augusta, GA
356,850 Jon Hobson, Plainfield, WI
18,990 Joel Klein, Indianapolis, IN
KING PEDE *(T & D Software)*
1,009,080 Michele Keggans, Akron, OH
145,035 Trisha Eckhoff, North Platte, NE
83,855 Mike Snyder, Allen, OK
KING'S QUEST III *(Sierra On-Line)*
210/210 David Ring, Lyman, NE
KNOCK OUT *(Diecom Products)*
472,995 Frank D'Amato, Brooklyn, NY
183,675 Rush Caley, Port Orchard, WA
135,990 Chris Donato, Euclid, OH
KORONIS RIFT *(Epyx)*
188,250 Mario Zuvieta, McAllen, TX
186,710 Tony Harbin, Cullman, AL
KUNG-FU DUDE *(Sundog Systems)*
32,000 Tony Geitgey, University Park, PA
16,130 Rod Miller, Sarasota, FL
14,305 David Schulze, San Antonio, TX
THE LAIR *(Freebooter Software)*
112,940 James Walton, Pittsburg, PA
LANDER *(T & D Software)*
780 Ari Enkin, Neapen, Ontario
LASER SURGEON: THE MICROSCOPIC MISSION *(Activision)*
42,767 Joe Stanley, Harrisburg, IL
LUNAR-ROVER PATROL *(Spectral Associates)*
73,500 Aron Wuelfing, Gladwin, MI
66,200 Chuck Lehotsky, N. Jackson, OH
45,700 Kameron Pence, Little Rock, AR
LUNCHTIME *(Tom Mix)*
116,825 Jason Bauer, Menominee, MI
MARBLE MAZE *(Diecom Products)*
353,220 David Boland, Dubuque, IA
30,650 Amber Reynolds, White City, Sask.
A MAZING WORLD OF MALCOLM MORTAR *(Radio Shack)*
10,510 Amy Carr, South Portland, ME
8,125 Sharon Blower, New Cumberland, WV
7,830 Robert Mefferd, Rockford, OH
MEGA-BUG *(Radio Shack)*
12,000 Matthew Smith, Courtenay, B.C.
10,044 Douglas Bacon, Middletown, CT
9,309 Alan Kramer, Cooksville, MD
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MEMOCARDS (THE RAINBOW, 8/87)
3,120 Lise Gagne, St-David, Quebec
1,964 Scott Walotkiewicz, Two Rivers, WI
1,640 Sara Mittelstaedt, Kiel, WI
METEOR STORM 3 (THE RAINBOW, 10/89)
5,025 Mark Brissie, Nashville, TN
MINE RESCUE *(SRB Software)*
670,200 Chuck Lehotsky, N. Jackson, OH
MISSION: F-16 ASSUALT *(Diecom Products)*
565,395 Tony Bacon, Mt. Vernon, IN
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787,300 Tony Bacon, Mt. Vernon, IN
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255,000 Joel W. Carmichael, Pine Bush, NY
56,520 John Mordosky, Allentown, PA
52,510 Chris Kremo, Bethel, CT
ONE-ON-ONE *(Radio Shack)*
1,310-0 Jon Breckel, Wilmington, OH
1,302-0 Thomas Payton, Anderson, SC
1,280-0 Randy Sunderland, Page, WV
OUTHOUSE *(MichTron)*
534,060 Kay Foxe, Kansas City, MO
59,641 Sam Zehel, Coal Center, PA
38,640 Dave Staub, Moundsville, WV
PAPER ROUTE *(Diecom Products)*
248,400 Cathy E. Kimble, Glendale, AZ
150,560 Heather Hamblen, Bar Harbor, ME
PITFALL II *(Activision)*
1,568,500 Sandy Baker, Martin City, MN
1,519,500 Jim Hammons, Martin City, MN
1,085,500 Tracey Lee Slack, Atwood, Ontario
POOYAN *(Datasoft)*
1,453,950 Lois Crowson, East Alton, IL
1,286,050 Craig Schneider, North Platte, NB
626,700 Charles Rene de Cotret, Saint-Laurent, P.Q.
POPCORN *(Radio Shack)*
150,560 Tom Cherubino, Brooklyn, NY
105,560 Heather Condit, Grafton, ND
26,889 Claude Jalbert, Matane, P.Q.
PROSPECTOR (THE RAINBOW, 12/88)
57,300 Andy DeGroat, Saginaw, MI
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51,850 Joel Klein, Indianapolis, IN
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220 Matt Chlapowski, Webster, MA
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QUIX *(Tom Mix)*
8,407,772 John Haldane, Tempe, AZ
RAD WARRIOR *(Epyx)*
49,931 Brandon Foster, Cutler, OH
22,192 Norman Gibson, Aylmer, P.Q.
21,424 Robert Mefferd, Rockford, OH
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1,780,870 Jocelyn Gagne, St-David, P.Q.
1,761,030 Eric Mellon, Newark, DE
1,666,670 Lise Gagne, St-David, P.Q.
RAMPAGE *(Activision)*
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4,011 Erin Carlton, Charleston, SC
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1,000,948 Steven Ujvary, Calgary, Alberta
323,167 Kenneth Hill, Severna Park, MD
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ZORK *(Infocom)*
350/328 Konnie Grant, Toledo, OH

Give us your best: Join the ranks of these courageous CoCoists in showing the Color Computer world your high score at your favorite micro-diversion. We want to put your best effort on record in THE RAINBOW's bimonthly "Scoreboard" column. All entries must be received 60 days prior to publication. Entries should be printed — legibly — and must include your full name, address, game title, company name and, of course, your high score. Each individual is limited to three score entries per month. Send your entries to Scoreboard, c/o THE RAINBOW.

For greater convenience, your high scores may also be sent to us through the MAIL section of our Delphi CoCo SIG. From the CoCo SIG>prompt, pick MAIL, then type SEND and address to: EDITORS.

SCOREBOARD POINTERS

In conjuction with THE RAINBOW's Scoreboard, we offer this bi-monthly column of pointers for game-playing readers' benefit. If you have some interesting hints, tips or responses to questions, or want help yourself, we encourage you to write to the Scoreboard, c/o THE RAINBOW.

In response to questions from:

• Jeremy Gross: The money should be discarded in *Dallas Quest* because it is useless in the rest of the game. You need to put items in the knapsack when you find them so your hands are free. Be sure to use the parachute when you jump off the plane. Then discard the parachute and the suspenders, as you will not need them any longer.

Jason R. Bauer
Menominee, Michigan

Scoreboard:
What do you do with the stick in *Riddle of the Ring*? Any help about this game would be greatly appreciated.
In *Lansford Mansion*, how do you get rid of the guard?
In *Power Stones of Ard*, what do you ask the hermit? What is the answer to the hermit's clue? I know his answer will tell me the item I need to destroy the dragon.
In *Dungeons of Daggorath*, on levels two and three there are ladders that lead upward. Should I go up these ladders? Every time I use a ladder I get killed by the first monster I come across.

Tony Durst
Brantford, Ontario

In Riddle of the Ring, *you will need the stick to kill the vampire down in the caves. Be sure to bring the jack-o'-lantern into the caves to light your way. Most of the items found in this game are of some use. Examining each item carefully usually reveals a clue. A book on mythology will provide clues also. Hint: Throw the moly at the hag.*

Scoreboard:
In *Hitch Hikers Guide to the Galaxy*, how do you get the fluff plant to grow? I have used the tea, but I can't get it back.

Peter Menning
Albuquerque, New Mexico

Scoreboard:
In *Thexder*, how do you get beyond Level 24? Are all the levels like levels 1 through 5?

Aaron Sebold
Hillsboro, Missouri

Scoreboard:
In *Raakatu*, you are able to look under the big rug and can locate the pit of spikes. But when I try to cross it, doing everything I can imagine, it is still impossible to go across the rug. There must be someone who knows how to do this.
In *The Seventh Link*, does anyone know what to do with the cleric behind the lightning bolt? I have a party of five now (Galahad, who is my own character, Tharon, Hogramil, Diralia and Juliano) but still can't pass this part of the game. Does one of my party members possess a certain power or skill that will help me here?
How do you exit Level 22 in *Gantelet II*? It has lots of exits, though none seem to lead to the next level. Here's a tip: The warrior can get the farthest in *Gantelet II*!

Andrew Yarrows
Easthampton, Massachusetts

Scoreboard:
In *Predator*, take the bottom door on Stage Eight to get to Stage Nine. I'm having difficulty leaving Stage Nine. Does anyone know how to do this?

Norman Gibson
Aylmer, Quebec

In Predator, *to exit Stage Nine you'll need to get the laser gun located at the extreme right of the stage. Be sure to get the extra life points first. Then get to the entrance guarded by the seahorse. Shoot the rock from under the seahorse. The seahorse will fall to a lower level. Don't kill the seahorse but jump on top of it and then jump to the entrance.*

To respond to other readers' inquiries and requests for assistance, reply to "Scoreboard Pointers" c/o THE RAINBOW, P.O. Box 385, Prospect, KY 40059. We will share your reply with all "Scoreboard" readers in an upcoming issue. For greater convenience, "Scoreboard Pointers" and requests for assistance may also be sent to us through the Mail section of our Delphi Coco SIG. From the CoCo SIG> prompt, pick Mail, then type SEND **and address to:** EDITORS. **Be sure to include your complete name and address.**

RAINBOW Illusions

Receiving mail is a part of any business operation. And believe me, we receive our fair share. As managing editor of THE RAINBOW, it is part of my job to read all letters containing editorial comments and suggestions — I hear the good and the bad. This lets me develop a feel for how RAINBOW readers interpret changes in the CoCo Community, and it gives me ideas about ways to address the various challenges we face.

In a recent letter Robert Murray, of St. Marys, Pennsylvania, expressed his feelings about the state of support for the CoCo. "After reading 'Print#-2' [March 1990, Page 10], to say I was enraged is an understatement. Mr. Falk says Tandy is scaling down its manufacturing processes for the CoCo. In another paragraph he talks about Tandy's probable decision to not build the Color Computer for the next several years. What is Tandy really going to do?"

Mr. Murray goes on to say, "You [RAINBOW] say indirectly that I have to put more money into the system to keep it up to date. I think you are helping to lead us down the Primrose path with the help of your advertisers and the people developing the new CoCo. Don't do anything to cost me more money."

Mr. Murray's letter brings up many interrelated issues. His comments and feelings are quite valid. And to the extent that we don't like the prospect of Tandy discontinuing the CoCo any more than he does, we agree with him. But based on his closing comments, I believe he is pointing his anger in the wrong direction. In the first place, THE RAINBOW is not responsible for the decisions Tandy makes. This is an important point as many readers who write letters and call us to complain about Tandy decisions seem to believe we are directly involved with these decisions. Oh, we can speculate and make predictions based on experience, but the simple fact is, until the decision is made, we don't know for sure.

We are a player in this game, not the dealer. Relative to many computer-oriented businesses, our position is somewhat unique. In addition to providing direct support to users, we provide a similar outlet for other businesses. New developments from our advertisers directly affect the way you compute by extending the capabilities of your machines. We are excited when we devote editorial coverage to these new products. Without new developments, where would the CoCo be? It would stagnate; this is evident at several points in the CoCo's life cycles.

On the other hand, the presence of new products is not without challenges. A major consideration is the extra cost of adding software and hardware to your system. If you want improvements, you have to pay for them. But then, as many in the CoCo Community are aware, new products for the CoCo cost far less than similar items in other computer lines. Also, you need only pay for what you want. If you like music, you can choose to purchase *Lyra* or *UltiMusE III*. If you don't want a CoCo 3, nobody can force you to buy one.

Yet it is this very flexibility that creates another challenge — the issue of compatibility. If you choose to not buy a CoCo 3, you cannot take advantage of the many fine products developed for it. If you don't have a disk drive, your software choices remain limited. The issue of compatibility is a big one here at THE RAINBOW. We are in a position where all readers want support for their own configurations. When we publish a 32K Extended BASIC program, we lose space in which we could publish a similar program that provides a greater number of features but requires a CoCo 3. We work as hard as we can to publish programs that work with as many CoCo setups as possible. And with the limited number of pages we have, this becomes increasingly more difficult. How can we change this? The answer is support.

The CoCo Community forms a triangle. On one side is THE RAINBOW, on another are the many vendors. The third side is represented by you, the readers and users. Except for its position as a vendor, Tandy does *not* hold an exclusive position in the design. As I have said before, Tandy introduced the machine. It is up to all of us to sustain it. If any one side of the triangle fails to support the other two, the triangle falls apart. Buying products from the advertisers allows them to provide new products to you and income to us. The latter allows us to provide more editorial space to you and more coverage for the advertisers. (I'll bet you didn't think geometry was important when you were in school.)

When any announcements are made regarding new members of the "CoCo" line, you can be sure we'll support them as well as we can, not because we are "in love" with the companies involved, but because those who are interested in the fate of the CoCo Community deserve and need that support. The future of the triangle is up to all of us.

— Cray Augsburg

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The retail stores listed below carry THE RAINBOW on a regular basis and may have other products of interest to Tandy Color Computer users. We suggest you patronize those in your area.

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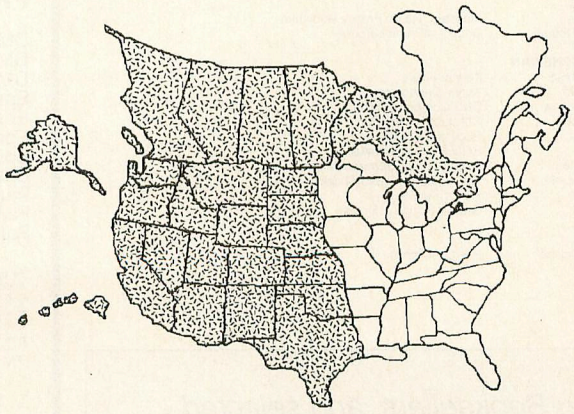

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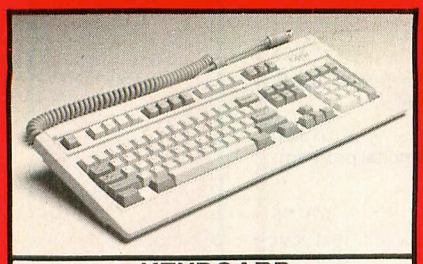

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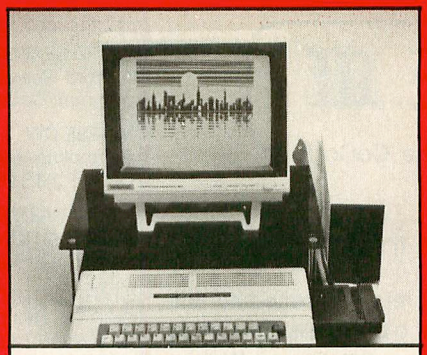

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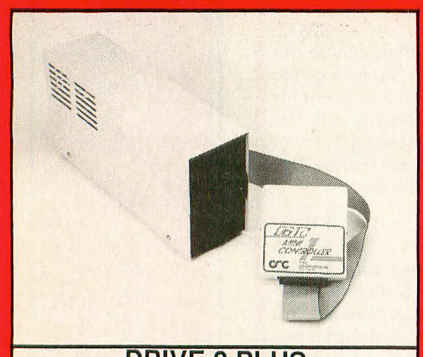
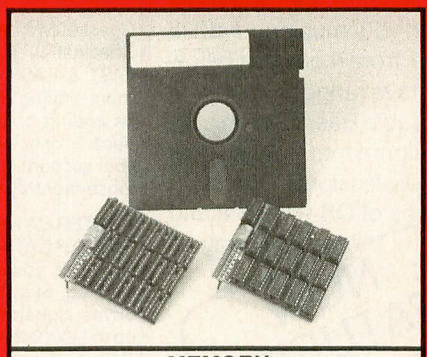


DRIVE 0 PLUS

- Double sided 360K MPI 52
- Disto DC-7 controller and cable **$178.45**
- **Double Drive 0 $310** (5 ship)



MEMORY

• 512K Bare Board	**$40**
• Populated 512K & Software	**$89**
• 1 MEG Bare Board	**$160***
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*requires 512K upgrade

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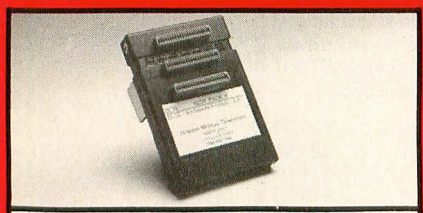
52	MPI 360K Bare Floppy	$ 78.00
HR-2	Dual Hi-res Adapter	$ 39.45
1200HC	1200 Baud Modem	$119.00



SLOT-PACK II

- replacement for multipack
- 3 slots, 2 switchable
- X slot for RS-232 and modem
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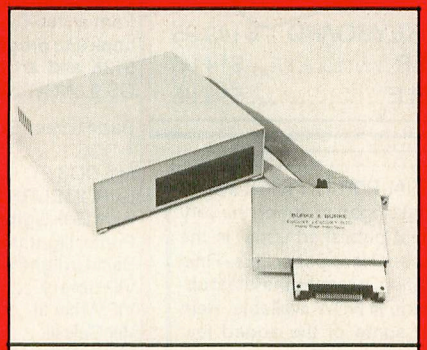
- 12 Volt adaptor needed for B & B and old drive controllers

MP-II	slot pack II	$89.45
AC-12	12 volt adaptor	$14.95



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20,000,000 Bytes or the equivalent to 125 R.S. 501's on line are packed into this hard drive, pre installed and ready to run. This complete easy to use package includes a Seagate 20 Meg Hard Drive, a DTC 5150 Controller and interface,* heavy duty case, power supply and fan and a 1 year warranty. This 20 meg Hard Drive will also work with Tandy and IBM clones. Basic driver, $29.95, lets you access this hard drive without need for OS-9.

See Rainbow Reviews 8/89

(9 ship)

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*Burke & Burke **reconditioned

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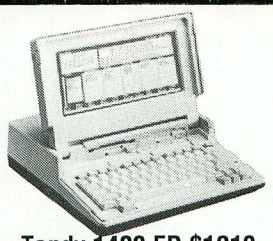

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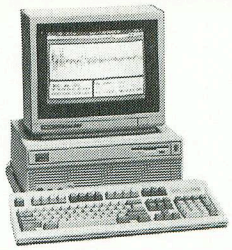
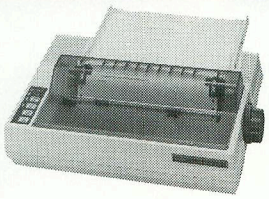
Tandy 102 32K $349*
Tandy WP-2 $279

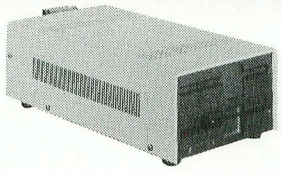
Color Computer 3
w/128K Ext. Basic $115*



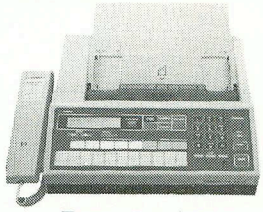
Tandy 1000 SL/2 $749
Tandy 1000 TL/2 $929



DMP-133 $199*



Color Computer Disk Drive
Drive 0 $179* Drive 1 $149



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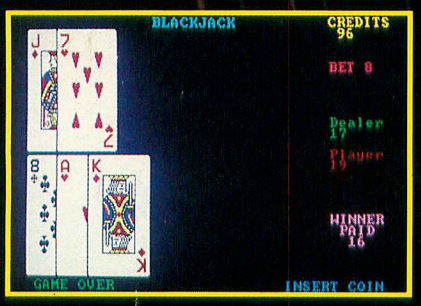

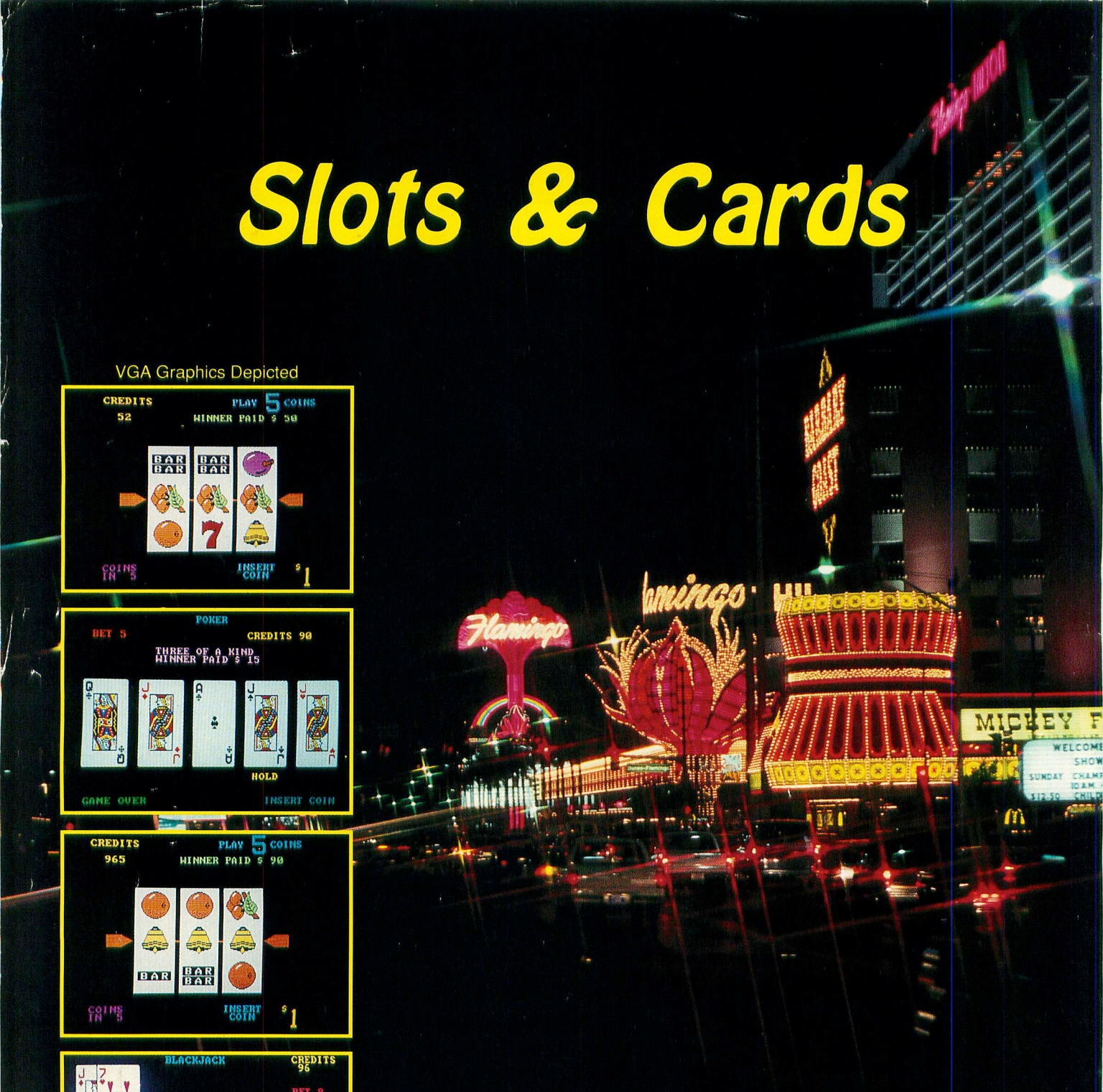

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